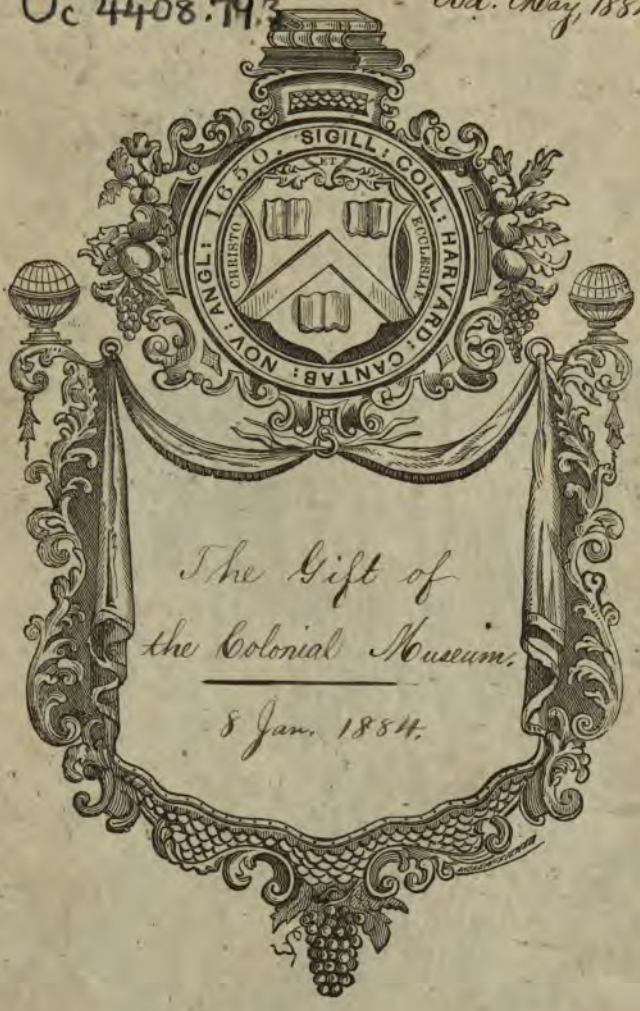

HANDBOOK

OF

NEW ZEALAND.

BY

JAMES HECTOR, M.D., C.M.G., F.R.S.,

DIRECTOR OF THE GEOLOGICAL SURVEY

WITH MAPS AND PLATES.

[THIRD EDITION. REVISED]

Wellington.
BY AUTHORITY: GEORGE DIDSBURY, GOVERNMENT PRINTER
1883.

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1883

1884. Jan. 8.
Gift of
The Colonial Museum.

PREFACE.

THIS Handbook was first published in accordance with a resolution of the Royal Commissioners appointed by His Excellency the Governor of the Colony to carry out and devise the proper representation of New Zealand at the Sydney Exhibition of 1879; a second edition was published for distribution at the Melbourne Exhibition of 1882; and the present revised edition has been prepared by direction of the Hon. Thomas Dick, Colonial Secretary.

The published literature bearing on New Zealand is very extensive. About eighty separate works have been quoted as published prior to the foundation of the colony in 1839, in which year the first number of the New Zealand Government *Gazette* was issued. Since that date the number of separate publications amounts to many hundreds, while the Parliamentary papers, both of the Provincial and General Governments, and the "Transactions of the New Zealand Institute," abound in valuable reports and memoirs that describe the history and resources of the country. Most of these works can, no doubt, be referred to at the great public libraries, and, to some extent, at the office of the Agent-General in London. Such research is, however, beyond the reach of most readers, and from the rapid disposal of former editions of this publication it is reasonable to infer that there is a demand for information of the kind now offered.

In the original preparation of this Handbook several previous works of a similar nature were largely drawn from, among which may be mentioned in particular the Jurors' Reports and Awards of the New Zealand Exhibition, 1865 (Dunedin, 1866); the admirable and exhaustive "Handbook of New Zealand" published by Sir Julius Vogel, K.C.M.G. (London, 1875); and the Official Reports on the New Zealand Court in the Philadelphia Exhibition, 1876, by the writer (London, 1877). The records of the various Government departments have been also largely made use of, particularly the annual volumes of statistics issued by Mr. W. R. E. Brown, Registrar-General. I must also acknowledge the valuable services of my assistants Mr. Bryce Bain and Mr. S. Herbert Cox, F.G.S.

In elaborating the details and revising the press of the present edition I have been ably assisted by Mr. A. T. Bothamley.

JAMES HECTOR.

Colonial Museum,
Wellington, 1st September, 1883.

ADDENDUM.

STATISTICS FOR 1882.

Population, &c.

Estimated population, 31st December, exclusive of Maoris	517,707
Marriages (per 1,000 of population, 7·07)	3,600
Births (per 1,000 of population, 37·32)	19,009
Deaths (per 1,000 of population, 11·19)	5,701
Immigrants	10,945
Emigrants	7,456
Excess of immigration over emigration	3,489

Education.

Number of public schools	911
Number of teachers	2,143
School attendance	68,288

Postal and Telegraphic.

Postal Correspondence—		
Letters		30,525,579
Post-cards		959,095
Books and parcels		2,396,255
Newspapers		13,313,099
Telegraphic messages		1,570,189
Postal revenue		£232,079
Postal expenditure		145,738

Imports and Exports.

Imports, value of		£8,609,270
Exports, value of		6,658,008
Value of Principal Articles of Export—		
Wool	£3,118,554	
Gold	921,664	
Produce	1,271,223	
Tallow	165,938	
Kauri gum...	260,369	
Timber	114,700	
Customs revenue		£1,515,916

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HANDBOOK OF NEW ZEALAND.

GENERAL DESCRIPTION.

Situation and Area.

The Colony of New Zealand consists of two islands called the North and South Islands, and a small island at the southern extremity called Stewart Island. There are also several small islets, such as the Chatham and Auckland Isles, that are dependencies of the colony. The entire group lies between 34° and 48° S. lat. and 166° and 179° E. long. The two principal islands, with Stewart Island, extend in length 1,100 miles, but their breadth is extremely variable, ranging from 46 miles to 250 miles, the average being about 140 miles, but no part is anywhere more distant than 75 miles from the coast.

Area of the Islands.

		Sq. Miles.	Acres.
The total area of	New Zealand is about ...	100,000 or	64,000,000
„ „	the North Island being ...	44,000 „	28,160,000
„ „	the South Island being ...	55,000 „	35,200,000
„ „	Stewart Island being ...	1,000 „	640,000

It will thus be seen that the total area of New Zealand is somewhat less than that of Great Britain and Ireland. The North and South Islands are separated by a strait only thirteen miles across at the narrowest part, presenting a feature of the greatest importance from its facilitating intercommunication between the different coasts without the necessity of sailing round the extremities of the colony.

The North Island was, up to the year 1876, divided into four provinces—viz., Auckland, Taranaki, Hawke's Bay, and Wellington. Taranaki and Hawke's Bay lie on the west and east coasts respectively, between the two more important provinces of Auckland on the north and Wellington on the south.

The South Island was divided into five provinces—viz., Nelson, Marlborough, Canterbury, Otago, and Westland (Southland was for a short time an independent province). Nelson and Marlborough are in the north, Canterbury in the centre, Otago in the south, and Westland to the west of Canterbury.

These provinces, however, in 1876 were divided into sixty-three counties—thirty-two in the North Island and thirty-one in the South Island—and provincial government ceased to exist.

Names of Counties.

In the North Island.—Mongonui, Hokianga, Bay of Islands, Whangarei, Hobson, Rodney, Waitemata, Eden, Manukau, Coromandel, Thames, Piako, Waikato, Waipa, Raglan, Kawhia, Taranaki, Patea, Tauranga, Whakatane, Cook, Wairoa, Hawke's Bay, Wanganui, West Taupo, East Taupo, Rangitikei, Manawatu, Waipawa, Hutt, Wairarapa West, and Wairarapa East.

In the South Island.—Sounds, Marlborough, Kaikoura, Waimea, Collingwood, Buller, Inangahua, Amuri, Cheviot, Grey, Ashley, Selwyn, Akaroa, Ashburton, Geraldine, Waimate, Westland, Waitaki, Waikouaiti, Maniototo, Vincent, Lake, Peninsula, Taieri, Bruce, Clutha, Tuapeka, Southland, Wallace, Fiord, and Stewart Island.

Mountains and Plains.

New Zealand is mountainous, with extensive plains, which in the South Island lie principally on the eastern side of the mountain-range, while in the North Island the most extensive lowlands lie on the western side. In the North Island the interior mountainous parts are covered with dense forest or low shrubby vegetation; while in the South Island these parts are chiefly open and well grassed, and are used for pastoral purposes.

In the North Island the mountains occupy one-tenth of the surface, and do not exceed from 1,500 to 4,000 feet in height, with the exception of a few volcanic mountains that are more lofty, one of which, Tongariro (6,500 feet), is still occasionally active. Ruapehu (9,100 feet) and Mount Egmont (8,300 feet) are extinct volcanoes that reach above the limit of perpetual snow: the latter is surrounded by one of the most extensive and fertile districts in New Zealand.

The mountain-range in the South Island, known as the Southern Alps, is crossed at intervals by low passes, but its summits reach a height of from 10,000 feet to 12,000 feet, and it has extensive snow-fields and glaciers. Flanking this mountain-range and occupying its greater valleys are extensive areas of arable land, which are successfully cultivated from the sea-level to an altitude of over 2,000 feet.

HISTORY.

First Settlement by Maoris.

New Zealand appears to have been first discovered and first peopled by the Maori race, a remnant of which still inhabits parts of the Islands. At what time the discovery was made, or from what place the discoverers came, are matters which are lost in the obscurity which envelopes the history of a people without letters. Little more can now be gathered from their traditions than that they were immigrants, and that when they came there were probably no other inhabitants of the country. Similarity of language indicates a Polynesian origin, which would prove that they advanced to New Zealand through various groups of the Pacific islands, in which they left remains of the same race, who to this day speak the same or nearly the same tongue. When Cook first visited New Zealand he availed himself of the assistance of a native from Tahiti, whose language proved to be almost identical with that of the New Zealanders, and through the medium of whose interpretation a large amount of the early information respecting the country and its inhabitants was obtained.

Discovery by Tasman.

The first European who made the existence of New Zealand known to the civilized world, and who gave it the name it bears, was Tasman, the Dutch navigator, who visited it in 1642. Claims to earlier discovery by other European explorers have been raised, but they are unsupported by any sufficient evidence. Tasman did not land on any part of the Islands, in consequence of having had a boat's crew cut off by the Natives in the bay now known as Massacre Bay, but contented himself by sailing along the western coast of the North Island, and quitted its shores without taking possession of the country in the name of the Government he served.

Visited by Captain Cook.

From the date of Tasman's flying visit to 1769 no stranger is known to have visited the Islands. In the latter year Captain Cook reached them in the course of the first of those voyages of great enterprise which have made his name illustrious.

The first of Cook's voyages of discovery began in August, 1768, when he was sent to Tahiti to observe a transit of Venus. After a run of eighty-six days from Tahiti, having touched at some other places, he sighted the coast of New Zealand on the 6th of October, 1769. On the 8th he landed in Poverty Bay, on the east coast of the North Island, which is therefore held to be the date of the first occupation of the country.

THE NATIVE RACE.

Origin and Traditional History.

There is nothing on record respecting the origin of the Maori people; but their arrival in New Zealand, according to tradition, is due to an event which, from its physical possibility, and from the concurrent testimony of the various tribes, is probably true in its main facts.

The tradition runs that generations ago a large migration took place from a distant island, to which the Maoris give the name of Hawaiki. Quarrels among the natives drove from Hawaiki a chief, whose canoe arrived upon the shore of the North Island of New Zealand. Returning to his home with a flattering description of the country he had discovered, this chief, it is said, set on foot a scheme of emigration, whereupon a fleet of large double canoes started for the new land. The names of most of the canoes are still remembered, and each tribe agrees in its account of the doings of the people of the principal "canoes" after their arrival in New Zealand; and from these traditional accounts the descent of the numerous tribes has been traced. Calculations, based on the genealogical staves kept by the *tohungas*, or priests, indicate that about twenty-seven generations have passed since the migration, which would give for its date about the beginning of the fourteenth century. The position of Hawaiki is not known, but there are several islands of this or a somewhat similar name.

Native Population, North Island.

The North Island is now supposed to contain a Native population of about 42,000, divided into many tribes; but their number is probably very largely over-estimated.

The most important tribe is that of the Ngapuhi, who inhabit the northern portion of the North Island, in the Provincial District of Auckland. It was among the Ngapuhi that the seeds of Christianity and of civilization were first sown, and among them are found the best evidences of the progress which the Maori can make. Forty years ago the only town in New Zealand, Kororareka, in the Bay of Islands, existed within their territory. Their chiefs, assembled in February, 1840, near the Waitangi ("Weeping Water") Falls, were the first to sign the treaty by which the Maoris acknowledged themselves to be subjects of Her Majesty; and although, under the leadership of an ambitious chief, Honi Heke, a portion of them in 1845 disputed the English supremacy, yet after being subdued by English troops and their Native allies (the Ngapuhi's own kinsmen) they adhered im-

plicitly to the pledges they gave, and since then not a shadow of doubt has been cast on the fidelity of the "loyal Ngapuhi."

Native Population, South Island.

The South Island Natives number but about 2,000, and they are spread over an immense tract of country, living in groups of a few families on the reserves made for them when the lands were purchased; for the whole of the South Island has been bought from the Native owners by the Government. Whatever may be the cause, it is a fact that the Natives of the South Island are less restless and excitable than their brethren in the North.

Physical Character.

As a rule the Maoris are middle-sized and well formed, the average height of the men being 5 feet 6 inches: the bodies and arms are longer than those of the average Englishman, but the leg-bones are shorter, and the calves largely developed. In bodily powers the Englishman has the advantage. As a carrier of heavy burdens the Native is the superior, but in exercises of strength and endurance the average Englishman surpasses the average Maori.

GOVERNMENT.

The colony was formerly divided into nine Provinces, each of which had an elective Superintendent, and a Provincial Council, also elective. In each case the election was for four years, but a dissolution of the Provincial Council by the Governor could take place at any time, necessitating a fresh election both of the Council and of the Superintendent. The Superintendent was chosen by the electors of the whole province; the members of the Provincial Council by those of electoral districts.

As has been already mentioned, this form of government was abolished in 1876, and the country was then divided into Counties and Road Board Districts; and to the County Councils and Municipalities the local administration formerly executed by the Provincial Governments is confided. The seat of Government was at Auckland up to the year 1865, when it was transferred to Wellington on account of the more central position of the latter place.

Form of Government.

Executive power is vested in a Governor appointed by the Queen, who acts in accordance with the principles of Responsible Government. Legislative power is vested in the Governor and two Chambers: one called the Legislative Council, consisting at present of forty-nine

members, nominated by the Governor for life; and the other the House of Representatives, elected by the people from time to time, and now consisting of ninety-six members. Until 1882 the House of Representatives was elected for five years, but by an Act passed in 1879 its normal term of service is now limited to a period of three years, which, however, may be shortened if the Governor should see fit to exercise his prerogative of dissolving it.

Except in matters of purely Imperial concern, the Governor, as a rule, acts on the advice of his Ministers. He has power to dismiss them and appoint others, but the ultimate control rests with the representatives of the people, who hold the strings of the public purse.

Electoral and Administrative.

Any man of twenty-one years and upwards, who is a born or naturalized British subject, and who has held for six months a freehold of the clear value of £25, or who has resided for one year in the colony, and in an electoral district during the six months immediately preceding the registration of his vote, is now, according to an Act passed in 1879, entitled to be registered as an elector and to vote for the election of a member of the House of Representatives; also, every male Maori of the same age whose name is enrolled upon a ratepayers' roll, or who has a freehold estate of the clear value of £25. And, by another Act passed on the same day, the duty is imposed upon the Registrar of each electoral district of placing on the electoral roll the names of all persons who are qualified to vote. Any person qualified to vote for the election of a member of the House of Representatives is also, generally speaking, qualified to be himself elected a member of that House. There are, however, certain special disqualifications for membership, such as grave crime, bankruptcy, and paid office (other than what is called political) in the colonial service. Four of the members of the House are Maoris, elected under a special law by Maoris alone.

The Colonial Legislature, which as a rule meets once a year, has power generally to make laws for the peace, order, and good government of New Zealand. The Acts passed by it are subject to disallowance by the Queen, and in a very few cases are required to be reserved for the signification of the pleasure of Her Majesty, but there have not been, in the course of the twenty-seven years since the Constitution was granted, more than half a dozen instances of disallowance or refusal of assent. The Legislature has also, with a few exceptions, ample power to modify the Constitution of the colony. Executive power is administered, as before stated, in accordance with the usage of Responsible Government as it exists in the United Kingdom,

Legislation concerning the sale and disposal of Crown lands, and the occupation of the gold fields, is exclusively vested in the Colonial Parliament.

There are in most towns in the colony municipal bodies, such as Mayors and Town Councils in England, invested with ample powers for sanitary and other municipal purposes; and there are in various country districts elective Road Boards charged with the construction and repair of roads and bridges, and with other local matters. There are also Central and Local Boards of Health appointed under a Public Health Act, which have authority to act vigorously, both in towns and in the country, for the prevention and suppression of dangerous and infectious diseases.

The above short summary of the system of government in New Zealand suffices to show that the leading characteristics of the British Constitution—self-government and localized self-administration—are preserved and, in fact, extended under the New Zealand Constitution; that there is ample power to regulate its institutions, and to adapt them from time to time to the growth and progress of the colony, and to its varied requirements; and that it is the privilege of every colonist to take a personal part to some extent, either as elector or elected, in the conduct of public affairs and in the promotion of the welfare of the community.

VEGETABLE AND ANIMAL PRODUCTS.

Vegetation.

The indigenous forest of New Zealand is evergreen, and contains a large variety of valuable woods. Amongst the smaller plants the *Phormium tenax*, or New Zealand flax, is of special value; whilst large tracts of country are covered with nutritious indigenous grasses, which support millions of sheep, and have thus been productive of great wealth to the colony. Many of the more valuable trees of Europe, America, and Australia have been introduced, and now flourish with a vigour scarcely ever attained in their natural habitats. In many parts of the colony the hop grows with unexampled luxuriance; whilst all the European grasses and other useful plants produce returns equal to those of the most favoured localities at Home. Fruit, too, is abundant all over New Zealand. Even in the latitude of Wellington oranges, lemons, citrons, and loquats are found, whilst peaches, pears, grapes, apricots, figs, melons, and, indeed, all the ordinary fruits of temperate climates abound. Roots and vegetables of all kinds grow luxuriantly.

Timber and Forest-trees.

The general character of the New Zealand woods resembles the growths of Tasmania and the Continent of Australia, most of them being harder, heavier, and more difficult to work than the majority of European and North American timbers. They vary, however, very much among themselves. Many varieties are very durable, and Manuka, Totara, Kauri, Black-birch, Kowhai, and Matai appear to be the most highly esteemed on the whole.

Strength of New Zealand Timbers.

The following table gives the results of experiments, extending over a period of some years, on the strength of the principal timbers of the colony:—

Results of Experiments on New Zealand Timbers.

[The dimensions of the specimens were 1 inch square and 12 inches long.]

No.	Native Names in Alphabetical Order.	Specific Gravity.	Weight of a Cubic Foot.	Greatest Weight carried with Unimpaired Elasticity.	Transverse Strength.
			lb.	lb.	lb.
1	Hinau, or Pokaka (*Elæocarpus dentatus*) ...	·562	33.03	94·0	125·0
2	Kahika, supposed white-pine	·502	31·28	57·3	77·5
3	Kahikatea, white-pine (*Podocarpus dacrydioides*)	·488	30·43	57·9	106·0
4	Kauri (*Dammara australis*)	·623	38·96	97·0	165·5
5	Kawaka (*Libocedrus doniana*)	·637	39·69	75·0	120·0
6	Kohekohe (*Dysoxylum spectabile*) ...	·678	42·25	92·0	117·4
7	Kowhai (*Sophora tetraptera* var. *grandiflora*)	·884	55·11	98·0	207·5
8	Maire, black maire (*Olea cunninghamii*) ...	1·159	72·29	193·0	314·2
9	Maire-tawhake (*Eugenia maire*)	·790	49·24	106·0	179·7
10	Mako (*Aristotelia racemosa*)	·593	33·62	62·0	122·0
11	Manoao (*Dacrydium colensoi*)	·788	49·10	200·0	230·0
12	Mangi, or mangeao (*Tetranthera calicaris*)	·621	38·70	109·0	137·8
13	Manuka (*Leptospermum ericoides*) ...	·943	59·00	115·0	239·0
14	Mapau, red mapau, or red-birch (*Myrsine urvillei*)	·991	61·82	92·0	192·4
15	Matipo-tarata (*Pittosporum tenuifolium*) ...	·955	60·14	125·0	243·0
16	Matai (*Podocarpus spicata*)	·787	49·07	133·0	197·2
17	Miro (*Podocarpus ferruginea*)	·658	40·79	103·0	190·0
18	Puriri (*Vitex littoralis*)	·959	59·50	175·0	223·0
19	Rata, ironwood (*Metrosideros lucida*) ...	1·045	65·13	93·0	196·0
20	Rewarewa (*Knightia excelsa*)	·785	48·92	93·0	161·0
21	Rimu, red pine (*Dacrydium cupressinum*) ...	·563	36·94	92·8	140·2
22	Taraire (*Nesodaphne taraire*)	·888	55·34	99·6	112·3
23	Tawa (*Nesodaphne tawa*)	·761	47·45	142·4	205·5
24	Tawiri-kohukohu, white mapau (*Carpodetus serratus*)	·822	51·24	80·0	177·6
25	Titoki (*Alectryon excelsum*)	·916	57·10	116·0	248·0
26	Totara (*Podocarpus totara*)	·559	35·17	77·0	133·6
27	Tawai, red-birch (*Fagus menziesii*) ...	·626	38·99	73·6	158·2
28	Tawai, black-birch (*Fagus fusca*)	·780	48·62	108·8	202·5
29	Whawhako (see also Maire) (*Eugenia maire*)	·637	39·63	75·0	120·0
20	Whau (*Entelea arborescens*)	·187	11·76	13·0	32·0

The experiments were conducted in the following manner: A pressure of 50 lb. was applied for two minutes (as measured by a sand-glass), and the sample was then released; 75 lb. was then applied for the same time, and then 100 lb., and so on, increasing by 25 lb. each time. Each time the sample was released the point on the deflection scale to which it returned was read, and when it came to be notably under the original reading it was allowed to remain unloaded for two minutes, to see whether it would in time recover itself. Then the pressure was gradually increased, without being removed, until the specimen broke.

A particular description of forty-four of the principal forest-trees will be found in the appendix.

Extent of Forest Land.

The proportion of forest land in each provincial district, as ascertained in 1873, was as under :—

	Percentage of Forest Land.
North Island—	
Auckland	7·20
Hawke's Bay	8·19
Taranaki	65·56
Wellington	42·85
South Island—	
Nelson	28·86
Marlborough	18·38
Canterbury	2·07
Westland	49·42
Otago ... ... } Southland ... ... }	11·84

Further particulars will be found in the table relating to the Crown lands of the colony, shown on the statistical map attached to this book.

The value of the export trade in timber for the decade 1868–77 amounted to £333,083, increasing from £15,653 in the former year to £50,901 in 1877. The trade is now rapidly growing, and in 1881 the total export was £73,926, of which £65,169 was for sawn timber.

Barks for Tanning and Dyeing.

A number of the native forest-trees and plants furnish good dyes from their bark. The Natives were acquainted with most of these, and dyed their flax mats and baskets with them.

A black dye can be made from the bark of the hinau *(Elæocarpus dentatus)*, and by adding a rust of iron an excellent non-corrosive ink is obtained.

Brown and red dyes are obtained from the bark of the towhai or tawhero *(Weinmannia racemosa)*. The Native mode of procedure is first to bruise the bark, and boil it for a short time along with the flax to be dyed, which, when the infusion is cold, is taken out and steeped thoroughly in red swamp-mud, rich in peroxide of iron; it is then removed and dried in the sun.

The towhai is a forest-tree abundant in many parts of New Zealand. The bark has been successfully used as a tanning agent. The dye obtained from this bark gives a very fast class of shades upon cotton; it can be sold at the same price as gambier and catechu. The extract is more astringent than that of the hinau, and needs only to be introduced to be accepted by tanners.

The bark of the tanekaha *(Phyllocladus trichomanoides)* is now exported to a small extent as a dye-stuff that imparts fine shades to fancy leathers for glove-making.

Tan-barks Native to New Zealand.

Name.	Native Name.	Percentage of Tannin.
Bark of Phyllocladus trichomanoides	Tanekaha	23·2
Bark of Elæocarpus dentatus	Hinau	21·8
Bark of Coriaria ruscifolia	Tutu	16·8
Bark of Eugenia maire	Whawhako	16·7
Bark of Weinmannia racemosa	Tawhero	12·7
Bark of Elæocarpus hookerianus	Pokaka	9·8
Wood of Fuchsia excorticata	Kotukutuku... ...	5·3
Bark of Knightia excelsa	Rewarewa	2·7
Bark of Myrsine urvillei	Mapau	1·4

Phormium Tenax (the New Zealand Hemp).

The history of what is termed the flax industry in New Zealand affords a remarkable instance of the difficulty experienced in developing the natural resources of a country if the commodities to be disposed of have not a previously-established market value.

When the colonists first arrived in New Zealand the valuable qualities of the Phormium fibre were well known, as it was in constant use by the Natives, and a very considerable trade in the article existed as early as 1828, when the Islands were only visited by whalers and Sydney traders, fifty thousand pounds' worth of the fibre being sold in Sydney alone between 1828 and 1832. At Grimsby, in Lincolnshire, a manufactory was also established in the latter year for the production of articles from the New Zealand fibre, which failed from some unexplained cause, notwithstanding that the results were not con-

sidered at the time unsatisfactory. From 1853 to 1860 the average annual value of the fibre exported was nearly £2,500, reaching as high as £5,500 in 1855; but up to that time the only fibre exported was that prepared by Native labour, no machinery of any kind being employed in producing the exported article. In 1860, therefore, when the Native disturbances affected the Waikato and other interior districts in the North Island, the preparation was confined to the Native tribes north of Auckland, so that the average export value was only £150 per annum. Attention was then directed towards the contrivance of machinery with the aid of which the fibre could be profitably extracted by European labour. In 1861 the increasing demand for white rope, and the limited quantity of manilla (which fibre depends for its production on native manual labour in the Philippine Islands), led to a rise in its value from £21 to £56 per ton, and even to £76 per ton in America during the late civil war. These high prices stimulated the endeavour to introduce Phormium fibre to compete with manilla, and several machines were invented for rapidly producing the fibre from the green leaf. With these machines the export trade again increased, so that from 1866 to 1871 the yearly average was valued at £56,000. This sudden revival of the trade led many to embark in it who were not only unacquainted with the new form of manufacture, but also unaccustomed to any kind of business that required special mechanical skill and careful elaboration of the details of management.

Commissioners were appointed in 1869 and 1870 to investigate and report on the manufacture and cultivation of the plant and the particular requirements of the market.

Recently the term "flax" has been changed to "hemp," with great advantage to the position which the fibre holds in the brokers' sale-rooms; but the fibre can be prepared so as to mix advantageously with true *Linum* flax in the manufacture of textile fabrics, and the shortness of the ultimate fibre is not an insuperable obstacle even to its being spun into unmixed yarns. It will therefore, in all probability, be necessary to adopt two names for the fibre to indicate the purpose for which it has been specially prepared, such, for instance, as Phormium hemp and Phormium flax. Samples of serge-sheeting, canvas sacking, and other varieties of cloth from unmixed Phormium fibre, have been manufactured in Scotland and sent out to the colony, and also samples of a very superior kind of canvas made from an admixture of Phormium with Riga flax. The fibre used in these experimental manufactures was prepared by Mr. C. Thorne by the use of alkaline solutions, and it is stated that such fibre would find a ready market in large quantities at from £60 to £90 per ton. Whether this would

be as profitable an application of the fibre as the production of hemp is, however, not yet established.

It is a matter of considerable interest that the coarser descriptions of Phormium hemp are again in demand for the purpose of manufacturing the stiff harsh twine that is best adapted for the self-binding reaping-machines.

The total quantity of Phormium exported between the years 1864 and 1876 amounted to 26,434 tons, valued at £592,218. The quantity exported in 1878 amounted to 622½ tons, valued at £10,666; in 1881 to 1,307 tons 15 cwt., valued at £26,285.

AGRICULTURE.

Allusion has been made to the area of country occupied by mountain-ranges in New Zealand, and the general position they occupy with reference to the geography of the country: it may be further stated that, with the exception of the higher alps, every part of the country is more or less adapted for settlement of some kind. A clearer idea of the value of the country and the purposes to which it is applicable is, however, obtained by the comparison of the rock-formations the decomposition of which produces the soils, as shown in the following table. From a study of this table it will be found that in the whole of the colony there are about 12,000,000 acres of land fitted for agriculture, wherever the form of surface is suitable, and about 50,000,000 which are better adapted for pasturage; but from these estimates allowance must be made for about 20,000,000 acres of surface at present covered by forest.

Classification of Geological Subsoil.

The following table gives a classification of the lands according to the geological subsoil:—

—	North Island.	South Island.	Totals.
	Sq. miles.	Sq. miles.	Sq. miles.
1. Fluviatile drifts, one-third agricultural	8,447	6,286	14,733
2. Marine Tertiary, two-thirds agricultural (rest pastoral)	13,898	4,201	18,099
3. Upper Secondary, coal-bearing, pastoral	2,390	2,110	4,500
4. Palæozoic, pastoral	5,437	20,231	25,668
5. Schistose, pastoral	...	15,308	15,308
6. Granite, worthless	...	5,978	5,978
7. Volcanic, one-sixth agricultural (rest pastoral) ...	14,564	1,150	15,714
	44,736	55,264	100,000

Varieties of Soil.

It would be beyond the scope of this description to give in detail the endless varieties of soil which are found in New Zealand, but attention may be drawn to the chief peculiarities.

Northern District.

In the North of Auckland, including the lower portion of the Waikato Valley light basic volcanic soils prevail, interspersed with areas of clay-marl, which in the natural state is cold and uninviting to the agriculturalist, but which, under proper drainage and cultivation, can be brought to a high state of productiveness. The latter soils, however, are generally neglected at the present time by the settlers, who prefer the more easily worked and more rapidly remunerative soils derived from the volcanic rocks.

North-western District.

In this district, which extends round to Taranaki and Wanganui, the soil is all that can be desired, and is probably one of the richest areas in the Southern Hemisphere. The surface soil is formed by the decomposition of calcareous marls, which underlie the whole country, intermixed with *débris* from the lava-streams and tufaceous rocks of the extinct volcanic mountains. The noble character of the forest which generally covers the area proves the productiveness of its soil, although at the same time it greatly impedes the progress of settlement.

North-eastern District.

In this district of the North Island, from Taupo towards the Bay of Plenty, the surface soil is derived from rocks of a highly siliceous character, and large areas are covered with little else than loose friable pumice-stone. Towards the coast, and in some limited areas near the larger valleys, such as the Waikato and the Thames, and also where volcanic rocks of a less arid description appear at the surface, great fertility prevails, and any deficiencies in the character of the soil are amply compensated for by the magnificence of the climate of this part of New Zealand. On the eastern side of the slate range which extends through the North Island the surface of the country is generally formed of clay-marl and calcareous rocks, the valleys being occupied by shingle deposits derived from the slate and sandstone rocks of the back ranges, with occasional areas of fertile alluvium of considerable extent. It is only the latter portions of this district which can be considered as adapted for agriculture, while the remainder affords some of the finest pastoral land to be met with in any part of the colony.

South-eastern District.

In the South Island the chief agricultural areas are in the vicinity of the sea-coast, but there are also small areas in the interior, in the vicinity of the lake districts, where agriculture can be profitably followed. The alluvial soils of the lower part of the Canterbury Plains, and of Nelson, Otago, and Southland, are the most remarkable for their fertility; but scarcely less important are the low rolling downs formed by the calcareous rocks of the Tertiary formation, which skirt the higher mountain masses, and frequently have their quality improved by the disintegration of interspersed basaltic rocks.

South-western District.

On the western side of the South Island the rapid fall of the rivers carries the material derived from the mountain-ranges almost to the sea-coast, so that comparatively small areas are occupied by good alluvial soil; but these, favoured by the humidity of the climate, possess a remarkable degree of fertility.

PROGRESS OF AGRICULTURE.

By the proper selection of soil, and with a system of agriculture modified to suit the great variety of climate which necessarily prevails in a country extending over 12 degrees of temperate latitude, every variety of cereal and root crop may be successfully raised in New Zealand; and, with due care in these respects, New Zealand will not fail to become a great producing and exporting country of all the chief food staples.

The progress made in agriculture has been very rapid, and the number of persons engaged in this pursuit is, as compared with other countries, very large, more than one in every five of the adult male population being in this way possessed of a permanent stake in the country. The number of holdings of one acre and upwards of cultivated land (exclusive of gardens attached to residences and Native holdings) enumerated in March, 1878, was 20,519, an increase of 1,769 on the year previous; in February, 1879, the number of holdings had increased to 21,048; and in February, 1882, it had further increased to 26,298. The exports of agricultural and farm produce increased from £262,930 in 1875, to £763,635 in 1879, and £1,114,253 in 1881.

The pursuit of farming has, at any rate in the South Island, been one of the most steadily prosperous industries of the colony; and although, in the course of time, the value of first-class land has naturally much increased, it is a question whether such enhancement of price is not more than counterbalanced by the improved and

cheaper facilities of access to market now offered; and certainly, when compared with the published accounts of the condition of agricultural affairs in Britain, the prospect offered by New Zealand farming must present a tempting aspect to those engaged in struggling along in the same pursuit in the Old Country.

On the next page will be found, in tabulated form, an account of land in cultivation, and agricultural produce of the various provincial districts of New Zealand, showing the nature of the holdings and the character of the cultivation for the past two years, indicating the increase or decrease respectively.

Average Yield of Crops.

The extent of land under wheat in the early part of 1882 was 365,715 acres, an increase on the area in wheat in 1881 of 40,766 acres. The aggregate produce of the wheat crop was estimated at 8,297,890 bushels. The estimated produce averaged 22·69 bushels per acre in 1882, against 25 bushels in 1881, the average for the last five years being 24·82 bushels per acre.

For Auckland the average yield was	26·40	bushels.
Otago	25·68	„
Canterbury	21·30	„
Wellington	23·22	„
Hawke's Bay	27·68	„

The estimated average yield of other produce for the same year, 1882, for the whole colony, was,—

Oats...	28·45	bushels per acre.
Barley	22·28	„ „
Potatoes	5·41	tons „

One of the statistical diagrams at the end of this pamphlet (No. XI.) will be found to give a graphic comparison of the wheat yield of New Zealand and the Australian Colonies.

Account of Land in Cultivation and Agricultural Produce.—Seasons 1881 and 1882.

(From statistics collected in February.)

Provincial Districts.		Numbers of Holdings over 1 Acre in Extent.			Extent of Land broken up, but not under Crop.	In Wheat.		In Oats.			In Barley.		In Potatoes.		In Other Crops.	Total Number of Acres under Crop, exclusive of Land under Grasses.	In Sown Grasses.			
																	In Hay.		In Grasses, after having been broken up (including such as in Hay).	Grass-sown Land not previously ploughed (including such as in Hay).
		Freehold.	Rented.	Part Freehold, Part Rented.		Area.	Estimated Gross Produce (in bushels).	For Green Food or Hay.	For Grain.	Estimated Gross Produce of Grain (in bushels).	Area.	Estimated Gross Produce (in bushels).	Area.	Estimated Gross Produce (in tons).	Area.		Area.	Estimated Gross Produce (in tons).		
		Acres.	Acres.	Acres.	Acres.	Acres.		Acres.	Acres.		Acres.		Acres.		Acres.	Acres.	Acres.		Acres.	Acres.
Auckland	1882	4,704	937	423	26,973	8,100	213,842	7,589	3,268	88,319	427	10,515	5,208	29,623	16,301	40,893	16,615	19,454	264,962	292,844
,,	1881	4,565	845	390	35,114	5,127	130,520	8,124	2,353	55,755	348	8,142	5,115	24,068	17,153	36,220	13,528	15,075	252,972	279,843
Taranaki	1882	943	249	139	1,351	2,960	76,771	375	1,975	60,019	94	2,363	644	3,154	3,008	9,056	2,703	4,212	35,419	93,002
,,	1881	722	261	139	2,294	2,103	49,068	467	1,230	36,495	168	3,910	644	2,646	2,558	7,170	2,357	3,368	30,800	84,127
Wellington	1882	2,142	913	334	5,027	12,013	278,884	2,369	8,902	259,150	640	18,484	1,537	9,750	7,808	33,269	7,353	11,084	121,475	750,426
,,	1881	1,863	774	278	15,385	11,559	239,193	1,974	7,365	174,056	731	18,424	1,758	8,908	4,796	28,174	5,649	7,702	106,305	666,240
Hawke's Bay	1882	683	267	132	10,484	1,608	44,503	957	3,947	88,582	296	7,252	840	5,037	2,672	10,320	9,720	14,349	103,514	579,233
,,	1881	647	210	112	14,530	2,008	43,297	997	2,911	60,409	517	17,682	864	5,051	2,788	10,065	6,813	8,853	94,622	566,802
Marlborough	1882	424	127	96	10,401	3,789	88,780	1,408	2,080	58,918	2,669	76,518	587	3,756	1,749	12,282	1,085	1,471	22,574	38,233
,,	1881	396	81	65	4,482	3,224	68,975	1,546	1,999	54,977	4,064	110,986	590	3,454	892	12,315	1,035	1,380	22,966	44,352
Nelson	1882	866	442	297	4,551	3,207	55,394	4,137	2,105	47,028	3,009	63,230	1,145	5,366	4,443	18,046	3,232	4,206	40,108	76,066
,,	1881	776	501	263	3,948	2,246	41,298	3,432	2,009	46,953	3,798	90,740	1,151	5,190	5,125	17,761	3,375	3,759	42,279	66,227
Westland	1882	229	69	21	82	2	32	411	10	233	2	4	247	824	343	1,015	208	229	3,503	6,286
,,	1881	150	87	20	1,308	5	...	465	1	30	5	...	214	622	201	891	265	150	2,604	7,594
Canterbury	1882	3,649	1,451	706	100,662	237,015	5,047,883	19,633	102,370	2,540,591	17,728	347,075	5,930	31,508	119,728	502,404	15,647	16,917	674,895	176,050
,,	1881	3,355	1,347	677	130,208	208,561	4,915,298	15,331	89,280	2,406,476	28,640	732,345	6,264	29,112	113,283	461,359	11,992	14,573	587,445	148,885
Otago	1882	4,092	1,377	586	89,021	97,021	2,491,801	24,552	118,730	3,782,008	4,943	138,652	6,402	32,872	123,550	375,178	11,860	17,168	496,425	154,054
,,	1881	3,447	1,514	657	86,203	90,125	2,661,148	18,351	107,882	4,056,810	8,607	239,047	5,963	26,974	110,378	341,796	9,083	13,919	448,577	124,359
Totals	1882	17,732	5,832	2,734	248,552	365,715	8,297,890	61,431	243,387	6,924,848	29,808	664,093	22,540	121,890	279,602	1,002,483	68,423	89,081	1,771,875	2,166,194
,,	1881	15,926	5,620	2,601	293,472	324,949	8,147,797	51,187	215,030	6,891,961	46,878	1,221,276	22,553	106,025	257,174	917,771	54,097	68,779	1,568,570	1,988,379
Increase in	1882	1,806	212	133	...	40,766	150,093	10,244	28,357	32,887	...	...	...	15,865	22,428	84,712	14,326	20,302	203,305	177,815
Decrease in	1882	...	...	...	44,920	...	...	...	...	...	17,070	557,183	13	...	...	...	...	...	...	...

PASTORAL PURSUITS.

The mildness of the winter season (which does not require that any special provision for the keep of stock during that period should be made), the general suitability of the country for grazing purposes, and the production of a superior class of wool, caused the attention of the first settlers to be much given to pastoral pursuits, so that at a very early date all grass lands were taken up as sheep or cattle runs. The success attending the pursuit enabled the runholders to a large extent to purchase the freehold of their runs, or the best portions of them; and by improvements in fencing and sowing with English grasses, which thrive remarkably well in the colony, the bearing capabilities of the land were increased many-fold. While in the North Island there are considerable tracts of grazing ground with natural herbage, a large extent of the country consists of hill land of varying quality, covered with forest, or bush, as it is called in the colony. This land, after the bush has been cut down and set fire to, if grass seed be sown upon the ashes, is converted in a few weeks into good grazing land. Much forest has already been destroyed in this manner, and the land supports large flocks and herds; and the same system will doubtless be extensively followed, as a large portion of country that would be so used is not available for agricultural pursuits. In the South Island the bush is chiefly confined to the western slopes of the dividing range; the open hills, plains, and downs to the east of the range being available for grazing purposes. The extent to which pastoral pursuits have been followed may be estimated by the quantity of stock in the colony in 1881 (when the census was last taken). The numbers of the undermentioned kinds were as follow:—

Horses	...	...	...	161,736
Cattle...	...	...	...	698,637
Sheep...	...	...	...	12,985,085

These numbers do not include the animals in the possession of aboriginal natives, no estimate of which can be given: while, however, possessing a considerable number of horses, they own but small numbers of sheep and cattle.

The annual crop of wool has on the whole steadily increased since the first settlement of the colony in 1839. In 1881 there was a slight decrease, which is to be explained chiefly by the large increase of rabbits (as during 1881 rabbit-skins were exported to the number of 8,514,685, valued at £84,744), and also to the consumption of nearly a million pounds of wool in the manufacture of woollen goods within the colony. The exports for the last nine years ending respectively on

the 30th September, or just before the shearing season begins, were as follow :—

	lb.
1873	42,233,470
1874	47,424,882
1875	49,942,148
1876	55,975,177
1877	56,520,278
1878	62,166,251
1879	62,643,497
1880	62,586,189
1881	60,477,151

While much of the country is only suited for sheep, a considerable portion is well adapted for the grazing of cattle. Much attention has been paid to, and capital expended on, the improvement of the various kinds of domestic animals; and some of the sheep and cattle fattened on grasses only may well bear comparison with the animals fattened on artificial food for the English markets.

The horses in the colony vary much in quality: for some years they realized such low prices that but little attention was paid to the breeding of good saddle-horses, and, as the Maoris possess large numbers of mares (not included in the census numbers), and breed from them without much regard to the improvement of stock, there has been a large increase in the number of small weedy animals. Where care has been taken excellent results have been obtained. As both draught-horses and thoroughbreds of the best strains of blood have been imported, first-class animals of either sort are obtainable, and always command a good value.

The various large agricultural shows periodically held in different parts of the colony, and heartily supported by farmers, stockowners, and the general public, have done much to encourage the good breeding of horses and cattle, and all other kinds of stock.

WOOL.

Wool is, undoubtedly, the most important production of New Zealand, its value in export approaching nearly treble that of gold.

Wool is divided into two classes, combing wool and clothing wool; from which are produced the two leading kinds of manufacture in the cloth trade—viz., worsted and woollen goods.

The first comprises the long-stapled wools of the Lincoln, Leicester, Cotswold, and Romney Marsh breeds of English sheep.

They are required for worsted goods, and, when combed, for bombazines, camlet, &c. This is a class of wool for the production of which the soil and climate of New Zealand are very suitable. The long-woolled sheep of Great Britain improve by the change; the length of the wool is increased, and all its valuable properties preserved, owing doubtless to the genial climate and absence of exposure to the extremes of an English temperature.

The Leicester breed has received great attention in New Zealand, and is the favourite with the Auckland sheep-farmers.

The Cotswold is a wool very similar to the Leicester, but of a somewhat deeper and harsher character, and lacks the "lustre" so much in demand for certain classes of manufactured goods. The Cotswold appears quite as much in favour with the New Zealand breeder as the Leicester, and probably its habits and character are more generally adapted to the climate of the South Island and the mountain pastures of the colony than any other long-woolled sheep. The Cotswold bears exposure better than the Lincoln or Leicester, will live and thrive on poor land, and come to more weight of carcass than any other breed.

The value of this breed as a cross with either Leicester or short-woolled sheep cannot be too much spoken of, and the favour in which crosses with the Cotswold are held is a sufficient proof of their excellence.

The Romney Marsh partakes in a measure of the qualities of the Leicester and Lincoln, being a soft, rich, and good handling wool, rather finer in quality than the Leicester, and having the glossy or "lustre" appearance of the Lincoln. Wool of this description is much in demand for certain fabrics, and is much sought after in the French markets.

The Cheviot is a wool that has grown into considerable popularity of late years, and is largely used in the worsted manufacture. It is a small fine-haired wool, of medium length and moderate weight of fleece.

The varieties of fabrics manufactured from these long-stapled wools are almost innumerable, and are perpetually varying according to the changes of fashion, though there are certain fixed kinds which may be interesting to mention—viz., *Sayes*, which is used for clerical and academical vestments. *Serge*, *Sateens*, light woven cloths for ladies' dresses. *Reps* are heavier, and from the method of weaving have a transverse ribbed appearance. *Cords* are like the last, but with longitudinal ribs. *Moreens*, watered cloths. *Merinoes*, finely-woven cloths, originally made from the fine Spanish wool called merino. *Paramattas*, fine cloths originally made from the Paramatta wool with silk warps,

though now woollen. *Camlets,* thin plain-woven cloths. *Damasks, Shalloon,* and, when made with cotton warps, *Crapes, Coburgs, Tammies, Delaines, Lasting,* and *Orleans* cloths.

The second kind or clothing wool comprises the short-stapled wool grown by the Southdown and Shropshire Down breeds of English sheep, and the Merino (Spanish) sheep, from which are manufactured woollen goods, including broadcloths and fancy kinds.

The Southdown is a short-stapled fine-haired close-growing wool, used chiefly for clothing purposes. The value of this breed to New Zealand sheep-farmers consists mainly in the improvements which crossing with it imparts to the carcass. Some breeders have crossed the Southdown with the Merino, and with cross-bred Romney Marsh and Merino.

The Shropshire Down is a breed which is growing every year into more importance. It produces a wool longer in the staple and more lustrous than any other Down breeds. It has been cultivated in New Zealand to a small extent only.

The Merino is the most valuable and important breed cultivated in New Zealand, and of sheep of this class the flocks of the colony are chiefly composed; they are of the Australian Merino variety, improved through the importation of pure Saxon Merino rams from Germany. The excellence of the Merino consists in the unexampled fineness and felting property of its wool, which in fineness and the number of serrations and curves exceeds that of any other sheep in the world. Fine Saxon Merino wool has 2,720 serrations to an inch, Merino wool 2,400, Southdown wool 2,000, and Leicester 1,850. These figures represent the felting properties of the various wools. The Merinoes adapt themselves to and thrive in every change of climate, and, with common care, retain all their fineness of wool as well under a burning tropical sun as in cold mountain regions.

In New Zealand the length of staple and weight of fleeces have been increased, without any deterioration in the quality of the wool.

Of the fabrics manufactured from these kinds of wool may be mentioned—*Doeskins,* technically called "seven-harness cloth." *Cassimeres* and *Kerseymeres* are "four-harness cloths," that is, four instead of seven threads in warp and weft, and in the kerseymeres the web, being subject to an extra milling, is rendered more compact. *Sataras,* ribbed cloths, highly dressed, lustred and hot-pressed. *Venetians,* woven as twills. *Meltons,* stout cloths not dressed or finished except by paring. *Beavers, Deerskins, Diagonals,* or fancy cloths. *Bedford-cords,* usually drab-coloured ribbed cloths, of great strength and durability. *Tweeds,* which are lightly felted, originally of Scotch manufacture, but now largely produced in this colony of a

quality and variety of pattern quite equal to any that can be imported.

Up to the present time the weaving industry in New Zealand has been confined to tweeds, plaiding, and blankets, and various woollen underclothing.

The value of wool exported in 1881 amounted to £2,909,760.

ANIMAL LIFE.

Until the systematic colonization of the Islands, New Zealand was very destitute of terrestrial or animal life suitable to the wants of civilized man, the only animals being a small rat, a dog (which had probably been introduced since the Islands were peopled by the present race), and pigs, the produce of some animals left by Captain Cook and the navigators that succeeded him: through the agency of the early missionaries, and by whaling ships, many useful animals and plants were then introduced. In more recent years all kinds of domestic animals, many of very high quality, have been imported, including valuable breeds of sheep and the American llama. Domestic poultry of almost every species have also been introduced, and, through the agency of the Acclimatization Societies, many species of game (such as hares, pheasants, partridges, black-game, red grouse, quail, &c.) and a host of the smaller birds of Europe and other countries have been spread throughout the Islands. The rivers also of New Zealand, which formerly produced only the eel and a few small salmonoid fishes of little value, are gradually being stocked with salmon and trout, both European and American, while perch, tench, and carp have also been satisfactorily acclimatized.

There are now in New Zealand about thirteen million sheep, seven hundred thousand cattle, and one hundred and sixty thousand horses.

WHALING.

New Zealand is the chief centre of the southern whale fisheries, and at certain seasons the less frequented harbours are visited by whalers for the purpose of refitting and carrying on shore-fishing and barrelling their oil. These are generally American ships, but Otago and Auckland whaling ships are also equipped by New Zealand owners. The sperm whale abounds in the region of the ocean lying to the north-east of New Zealand, but stragglers are found all round the coast. In the open sea and to the south the most prized whale next to the sperm is the black whale, or tohoro *(Eubalæna australis)*, which is like the right whale of the North Sea, but with baleen of less value. Along the

shores the chief whales captured are the hump-back *(Megaptera)* and rorqual *(Sibbaldius)*, which become very abundant when not disturbed for a few years.

Value of Whale Oil.

In 1875, 20,845 gallons of black oil were exported, valued at £4,100, and 7,775 gallons of sperm, valued at £2,894. In 1877, 15,047 gallons of sperm-whale oil were exported, valued at £4,032. In 1881, 20,686 gallons of sperm-whale oil were exported, valued at £5,059.

Seal Fur.

The sea-bear, or fur seal *(Arctocephalus cinereus)*, is found on the remote parts of the coasts, about a thousand skins being taken every year by boating parties. In 1875 there were exported 2,767 seal-skins, valued at £4,050; and in 1877 there were exported 1,503 seal-skins, valued at £1,652. In 1881, 1,259 seal-skins were exported, valued at £1,717.

FISHERIES.

The assemblage of fishes which we find in the New Zealand seas on the whole represent the characteristic forms of the southern or Lusitanian province of European coasts, or, in other words, our New Zealand fishes resemble those which are found on the coast between Madeira and the Bay of Biscay more than they do those which are caught about the North of Scotland. Of thirty-three sea fishes that are used as food in New Zealand, we have among the constant residents on all parts of our coast the Hapuku, Tarakihi, Trevally, Moki, Aua, Rock Cod, Wrasse, and Patiki; and while the Snapper, Mullet, and Gurnet are only met with in the North, the Trumpeter, Butter-fish, and Red Cod are confined to the South. But, with the exception of the Patiki, or Flounder, and the Red Cod, none of these are representatives of fishes that are common even in the South of Britain, while from the more northern seas similar fishes are altogether absent.

In addition to those which remain throughout the year, a very large number of the fishes of the New Zealand coast, owing to its geographical position, are pelagic in their habits, and roam over a wide range of ocean, visiting our shores only irregularly in pursuit of food. Of the edible fishes of this class, by far the largest number are visitors from warmer latitudes, such as the Frost-fish, Barracouta, Horse-mackerel, King-fish, Dory, Warehou, Mackerel, and Gar-fish, while only the Ling, Hake, Haddock, and a few other fishes, which are rare, and worthless as food, are among those of more southern types which reach the New Zealand coast in their migrations.

There is, however, no reason to complain of any want of useful variety in the New Zealand fishes as compared with Britain, for we find that out of 208 species of fishes enumerated as occurring in the British seas, including many which are extremely rare or only occasional visitors, only 40 are considered to have a marketable value. In New Zealand, notwithstanding our very imperfect knowledge (especially with regard to the gregarious tribes, which there is reason to believe inhabit shoals at some distance from land), out of 192 sea fishes, some of which are only known from single specimens, we have nearly as many varieties used for food as are brought to market in the British Islands.

Of 140 species of fish enumerated as found in New Zealand, 67 species are, so far as we know, peculiar to New Zealand; 75 are common to the coasts of Australia or Tasmania; while 10 species are found in New Zealand and other places, but not in the Australian seas. New Zealand Ichthyology thus presents a very distinct character, the thorough deciphering of which affords a wide field for future observation and scientific investigation.

The following is a list of the fishes which are chiefly met with in the market:—

Hapuku ...	... Oligorus gigas
Kahawai ...	... Arripis salar
Red Snapper ...	... Anthias richardsoni
Snapper ...	... Pagrus unicolor
Tarakihi ...	... Chilodactylus macropterus
Trumpeter ...	... Latris hecatcia
Moki	... Latris ciliaris
Frost-fish ...	... Lepidopus caudatus
Barracouta ...	... Thyrsites atun
Horse-mackerel	... Trachurus trachurus
Trevally ...	... Caranx georgianus
King-fish ...	... Seriola lalandii
John Dory ...	... Zeus faber
Boar-fish ...	... Cyttus australis
Warehou ...	... Neptonemus brama
Mackerel ...	... Scomber australasicus
Rock Cod ...	... Percis colias
Gurnard ...	... Trigla kumu
Mullet	... Mugil perusii
Sea-mullet ...	... Agonostoma forsteri
Spotty	... Labrichthys bothryocosmus
Butter-fish ...	... Coridodax pullus
Haddock ...	... Gadus australis
Red Cod ...	... Lotella bacchus
Whiting ...	... Pseudophycis breviusculus
Ling	... Genypterus blacoides
Turbot ...	... Ammotrites guntheri
Brill ...	... Pseudorhombus scaphus
Flounder or Patiki...	Rhombosolea monopus
Sole ...	... Peltorhamphus novæzealandiæ
Gar-fish ...	... Hemirhamphus intermedius
Grayling ...	... Prototroctes oxyrhynchus
Smelt ...	... Retropinna richardsoni
Kokopu ...	... Galaxias fasciatus
Minnow ...	... Galaxias attenuatus
Sand-eel ...	... Gonorhynchus greyi
Anchovy ...	... Engraulis encrasicholus
Pilchard or Sardine..	Clupea sagax
Sprat ...	... Clupea sprattus
Eel (tuna)	... Anguilla aucklandii
Black eel ...	... Anguilla australis
Conger-eel...	... Conger vulgaris
Silver-eel ...	... Congromurænahabentata
Leatherjacket	... Monacanthus convexirostris
Smooth-hound	... Mustelus antarcticus
Sting-ray ...	... Trygon thalassia
Skate ...	... Raja nasuta.

GEOLOGY.

The geological reports, maps, and sections which are issued by the Geological Department of New Zealand indicate our present knowledge of the structure of the Islands and the distribution of the chief groups of rock formations; and the leading features have been drawn on the reduced map which accompanies this work.

The following classification has been adopted in the construction of this map; but, notwithstanding the large amount of data that has been collected, the extent and rugged nature of the country and the very limited staff have precluded minute surveys being effected, so that the attempt now made to express the results obtained in a systematic form must be considered as merely provisional.

Classification.	Approximate Thickness in feet.
*I. Post-tertiary and Recent.	
II. Pliocene	1,500
III. Upper Miocene	500 to 1,000
IV. Lower Miocene	1,000 to 1,500
V. Upper Eocene	500 to 700
VI. Cretaceo-tertiary	2,000 to 5,000
VII. Lower Greensand	500
VIII. Jurassic	3,000 to 5,000
IX. Liassic	2,000
X. Rhætic and Trias	5,000 to 8,000
XI. Permian	6,600 to 7,000
XII. Lower Carboniferous and Upper Devonian...	7,000 to 10,000
XIII. Lower Devonian	5,000
XIV. Upper Silurian	3,000
XV. Lower Silurian	7,000 to 10,000
XVI. Foliated Schists.	
XVII. Crystalline Rocks.	
XVIII. Granite.	
XIX. Plutonic and Dyke Rocks.	
XX. Basic Volcanic Rocks.	
XXI. Acidic Volcanic Rocks.	

I. Post-tertiary (Recent).

a. *Moa beds.*

b. *Alluvia.*

c. *Raised beaches, moraines, &c.*

The deposits belonging to this period have accumulated with great

* These numbers refer to the colours on the geological map.

rapidity in New Zealand, owing to the mountainous character of the country giving to the rivers, even when of large size, the character of torrents, which are liable to occasional floods of extreme violence. To some extent, also, the remarkable indications of change which are everywhere manifest must be attributed to alterations of relative level which have affected the surface, some of which have occurred during the present century. Such changes are more easily detected on the sea-coast, where they effect sudden alterations of the shore-line, but there is no doubt that they have been equally potent in inland districts, and have caused, for instance, marked alterations in the courses of some of the rivers.

The Maori race is considered, from the evidence afforded by their traditions, to have been established in New Zealand for little more than five hundred years before the first arrival of Europeans; but during that period, while the Islands were being explored in all parts by this intelligent and adventurous native race, the spread of fires, causing the destruction of the primæval forests and rank vegetation, was the means of setting free vast accumulations of loose soil and disintegrated rock that were formerly retained on the mountain-slopes. The material thus displaced has accumulated in the river-courses, causing them to raise their beds above the adjacent lands, so that they have broken away from their channels in many places.

The race of gigantic Moa birds *(Dinornis)* had its maximum development in the New Zealand area, and only became extinct during the recent period, but their extermination must have commenced at an earlier date than the first human occupation, as their bones are found deeply embedded in the gravels and swamps, while the evidences of human occupation are confined to the surface-soil, shelter-caves, and sand-dunes.

In a rugged and mountainous country like New Zealand it would evidently require a very large-scale map to show the innumerable fringes of river-beds, and other small patches of Post-tertiary deposits, and accordingly these have been neglected in the geological map, and indications of the recent deposits have been limited to those places where the structural rock of the country is not exposed. These deposits, however, cover a considerable area of country in the Canterbury Plains, the Mackenzie country, around the mouth of the Waitaki River, and in the Mataura, Waimea, and Five Rivers plains, in the South Island; and in the Manawatu, Waikato, Thames, and Kaipara districts, and the isthmus between Awanui and North Cape, in the North Island.

II. Pliocene.

a. *Terrace plains; Scinde Island limestone.*
b. *Pumice sands and lignite series.*
c. *Kereru Rotella beds, Motunau, &c.*

This formation belongs to a period when New Zealand was the mountain-range of a greatly extended land-area, and when, in the North Island, the volcanic forces had their greatest activity, attended with the rapid elevation of local areas of fossiliferous deposits that were at this period forming in adjacent seas. In the South Island no marine deposits of importance belonging to this period are present, but the great area of land above the shore-line intensified the erosive action of the glaciers radiating from the mountain centres, and gave rise to enormous deposits of gravel, such, for instance, as compose the greater part of the Canterbury Plains, and the Moutere Hills in Nelson.

The marine Pliocene beds are characterized by the great abundance of *Rotella zealandica*, with *Dosinea anus*, *Struthiolaria fraseri*, *Chione*, and a large form of *Buccinum maculatum*, with many other forms.

The economic importance of this formation is very considerable, from its containing the richest deposits of alluvial gold that form the support of the mining population. The beds cover a considerable surface-area, both in the North and also in the South Island.

In the North they form notable beds around Manukau Harbour; they cover a considerable area of country in the districts between Alexandra and the Upper Thames, and stretch from Lake Taupo towards Opotiki, fringing the coast between that point and Katikati. They also occur as an important deposit at Wanganui, where they are highly fossiliferous, and, stretching back from there to the head waters of the Rangitikei River, flank the Ruahine Range, envelope the base of Tongariro and Ruapehu, and are subsequently traced as far as Lake Taupo, which they reach as a narrow strip on the banks of the Upper Waikato River. They further flank the Ruahine Range on the east side, and extend north as far as Moeangiangi, and, besides appearing as isolated patches between, form the low hills surrounding Poverty Bay. Where they flank the Ruahine Ranges they have a great thickness, and being there of marine origin are highly fossiliferous; in that district they have also been involved in extensive structural movements, so that in many places they have been completely overturned. Elsewhere they are nearly horizontal, although the marine beds have been locally raised to an altitude of 300 feet above sea-level.

In the South Island their principal development is on the West

Coast between Lake Brunner and Bruce Bay; and in the Canterbury Plains, where they fringe the range between Timaru and the Waipara River. They also occur in the Hurunui Plains; around Lake Tripp; at the outlets of Lakes Ohou, Pukaki, and Tekapo, fringing the Older Carboniferous rocks in the Mackenzie country; from the Wanaka and Hawea Lakes as far south as Wakefield; the upper lacustrine gravels of the Manuherikia and Maniototo Plains; also between Lake Te Anau and the Mararoa River; and in the Southland Plains, a part of which is composed of these beds.

III. Upper Miocene.

a. *Wanganui series.*
b. *Manawatu Gorge limestones.*
c. *Castlepoint beds.*
d. *Ross beds.*
e. *Waitotara and Awatere beds.*

The marine beds of this age are limited in their extent to the southern and eastern districts of the North Island, and in the South Island occur as patches, inland from Timaru, between Peel Forest and the Waitaki River; at the mouth of the Waipara; at Ross; to the south of Greymouth; and in Nelson, from Lake Rotoiti to the sea; but here, as at many other places, these beds are often represented by gravel conglomerates that, from the absence of fossils, have not been distinguished from the preceding formation.

They consist of a series of sandy, calcareous, and argillaceous strata, the distribution of which, and as a rule also the mineral character, indicate that they were related to a closely adjacent shore-line, as they often pass, almost suddenly, from coarse conglomerates into narrow strips of fine mud and clay, such as are deposited in the centres of deep channels and inlets.

The New Zealand seas have yielded about 450 species of existing shells, of which 120 have been found in this formation, together with 25 forms which are now extinct.

They are specially characterized by the occurrence of *Ostrea ingens, Murex octagonus, Fusus triton, Struthiolaria cingulata, Chione assimilis,* and *Pecten gemmulatus.*

IV. Lower Miocene.

a. *Maungapakeha Valley beds.*
b. *Taipo, Awamoa, and Pareora beds.*

This formation, which is distinguished from the foregoing chiefly by its fossils, is a calcareous and argillaceous formation, widely spread over the east and central part of the North Island and both sides of

the South Island, and, when not removed by denudation, can be traced to an altitude of 2,500 feet above the sea. It represents a period of great depression, and the deposits are remarkable for the absence of evidence of volcanic activity in any part of the region, and for the abundance of marine life, about 55 existing mollusca and 110 extinct species having been obtained from this formation, amongst which *Dentalium irregulare, Pleurotoma awamoaensis, Conus trailli, Turritella gigantea, Buccinum robinsoni,* and *Cucullæa alta* are the most notable.

The principal areas of development of these beds are up the Wanganui River; between the East Cape and Hicks Bay; between Tokomarua and Tolago Bay, and inland from there to Waipaoa; while on the east coast of Wellington they occur as a long strip, reaching nearly to Cape Kidnappers.

In the South Island they occur in several localities, as at the Port Hills, Nelson; between the Awatere River and Cape Campbell; in the Cheviot Hills, and reaching south from there to Mount Grey; between Marsden and Inangahua, following the course of the River Grey; as a narrow strip between Waimate and Geraldine; and in the Kyeburn Flats on the eastern side of the Maniototo Plains, where they pass into the Upper Gold Drifts of the interior of Otago, which are lacustrine beds of equivalent age. They also occur as several small patches which require no special mention. In some places heavy deposits of an inferior quality of brown coal occur in this formation.

V. Upper Eocene.

a. *Mount Brown beds.*
b. *Hutchinson's Quarry beds.*
c. *Nummulitic beds.*

This is a very marked formation of calcareous sandstone, composed of shell fragments, with corals and Bryozoa, and is a shallow-water and littoral deposit.

Intense volcanic activity prevailed during this period in both Islands, and the calcareous strata are frequently interbedded with contemporaneous igneous rocks and tufas, and in the North Island are often replaced by wide-spread trachyte flöes and volcanic breccias.

The lower part of this formation passes at places into an imperfect nummulitic limestone, or a friable calcareous sandstone, evidently deposited in shallow seas, and forming the lowest member of the proper marine Tertiary series.

The more noticeable fossils in this formation are *Struthiolaria senex, Pecten hutchinsoni, Pecten hochstetteri, Terebratella suessi, Meoma crawfordi, Bryozoa,* and numerous corals. In greensands at the base

of this formation, remains of a huge zeuglodont cetacean *(Kekenodon)* have been discovered by Mr. A. McKay, allied to those found in strata of equivalent age in Europe and America.

The distribution of these beds is limited in area, the principal development being about the Waiau River, in Southland, and on the eastern side of Te Anau Lake, with a few patches up the east coast of the South Island at Oamaru, Geraldine, Mount Somers, and Mount Grey; while in the North Island they are principally developed from Cape Kidnappers south and inland up the Tukituki River. A small patch of the same beds also occurs at Mokau.

VI. Cretaceo-tertiary.

a. *Grey marls.*
b. *Ototara and Weka Pass stone.*
c. *Fucoidal greensands.*
d. *Amuri limestone, chalk-marls, and chalk with flints.*
e. *Marly greensands.*
f. *Island sandstone (Reptilian beds).*
g. *Black grit and coal formation.*

These constitute the Cretaceo-tertiary group, being stratigraphically associated and containing many fossils in common throughout, while at the same time, though none are existing species, many present a strong Tertiary facies, and in the upper part only a few are decidedly Secondary forms.

The distribution of this formation shows that it was not, like the foregoing formations of later date, deposited in relation to a form of the land like that at present obtaining in the New Zealand area, except in the vicinity of some of the oldest and most lofty land-masses in the south, which appear to have remained above the water-line since the Lower Cretaceous period.

The upper part of this formation is a deep-sea deposit, but the lower subdivisions indicate the close vicinity of land, and are replaced in some areas by true estuarine and fluviatile beds containing coal.

The marine fossils include, besides well-marked Greensand forms, such as *Ancyloceras*, *Belemnites*, and *Rostellaria*, a number that have still a marked affinity to the Tertiary Fauna. Saurian bones occur, of the genera *Plesiosaurus*, *Mauisaurus*, *Leiodon*, &c., in this formation, but they have only been found, as yet, over a limited area on the east side of the South Island.

The black grit, which is the lowest marine bed of this group, resembles, in mineral character and the contained fossils, the Carstone and Calcareous Greensand of England.

In the upper part of this formation the valuable building-stone

known commercially as "Oamaru stone" occurs, which is a calcareous sandstone very easily worked, but hardening when exposed to the weather.

The most valuable coal deposits of New Zealand occur in the Cretaceo-tertiary formation, but always at the base of the marine beds of the formation, in every locality where they occur. The coal-bearing beds always rest upon the basement rock of the district, marking a great unconformity and the closing of a long-persistent land-area at the period to which they belong.

Thus the coal is immediately overlaid by the grey marls in the Waikato, by the fucoidal greensands at Whangarei, and by the Island sandstone in Otago and on the west coast of the South Island.

The coals immediately beneath the marine beds are everywhere hydrous brown coals, but on the West Coast these rest upon an immense formation of micaceous sandstones, grits, and conglomerates, in which are seams of valuable bituminous coal, and this lower part of the formation is possibly the equivalent in time of the Lower Greensand group.

The same fossil plants are found associated with all these coal deposits, and even those of highest antiquity abound in the fossil remains of dicotyledonous and coniferous trees of species closely allied to those represented in the existing flora of the country.

In the Malvern Hills, where the strata overlying the coal contain abundance of Lower Cretaceous fossils, the dicotyledonous leaves are associated with *Alethopteris, Oleandridum (Tæniopteris)*, and other forms that are prevalent in the underlying Jurassic beds. The same association takes place in the sandstones overlying the coal on the West Coast.

It appears from this that the land surface preceding the great depression during Cretaceo-tertiary times survived to a later date in the north than in the south of New Zealand, the beds overlying the coal in the north being generally of younger Cretaceous age.

This formation has a large distribution from north to south, but coal is only found at its base in a limited number of localities.

At Kawakawa, and between that point and Whangarei, coal has been found; and again in the Waikato, at Kawhia and Mokau. On the east side of the North Island coal-seams are yet unknown, associated with these beds, but strong escapes of petroleum and gaseous hydrocarbons are found in many places.

On the western slope of the main axis of the South Island all but the lower series of beds included in this formation occur in disconnected areas from Picton and Collingwood to Jackson Bay, being in every case associated with coal; and at the Buller and Grey the well-established coal mines are in seams that belong to this period.

At Preservation Inlet some divisions of the formation are found, as also at the Nightcaps; on the Mataura; at Kaitangata and Green Island—in every case associated with coal; while from Shag Point up to the Waitaki River they have a further development.

Several other patches occur going northward along the East Coast, and, as a rule, coal-seams occur at their base until reaching the Malvern Hills; but north of this point, as at the Amuri Bluff, they pass down conformably into the next-described formation.

The Island Sandstone, with its characteristic fossils, underlies and is associated with the older gold drifts that occupy the interior plains of Otago, proving that these great valleys were excavated prior to the Cainozoic period.

VII. Lower Greensand.

a. *Amuri group on East Coast.*

b. *Bituminous coals on West Coast.*

These beds consist of green and grey incoherent sandstones, with hard concretions, and large masses of silicified wood.

This formation, which is confined to a few localities of limited extent, is very rich in fossils of the genera *Belemnites* and *Trigonia*, with a few Saurian bones and large Chimæroid fishes. Its typical development is at the Waipara and Amuri Bluff, but equivalent beds are also found on the east coast of the North Island in several localities, and they have a considerable development in the neighbourhood of East Cape, extending inland as far as Hikurangi.

VIII. Jurassic.

a. *Mataura series.*

b. *Putataka series.*

c. *Flag Hill series.*

These beds, which are the youngest of the Lower Secondary formation in New Zealand, require mention under their several subdivisions, although on the general map no distinction has been made between them.

The *Mataura series* consists largely of estuarine beds, marine fossils being absent or rare. It consists of dark-coloured marls and fine-grained sandstones, and contains the fossil remains of a number of plants, of which eight species have been recognized. Amongst these are *Camptopteris*, *Cycadites*, and *Echinostrobus*, which connect these with the plant-beds of the next lower formation. Those found at Waikawa and Mataura Falls are especially interesting from at least one species, *Macrotæniopteris lata*, being identical with a plant found in the Rajmahal beds of India, which are considered to be of Liassic age. The same plants are found in the Clent Hills plant-beds, and

from the natural sections, and also from the very characteristic fossils immediately below them, there can be no doubt that they should be referred to the Upper Oolite period.

The *Putataka series*, which has its typical development at Waikato Heads as marlstones, is represented in southern districts by coarse-grained sandstones, which pass near the base of the formation into conglomerates with bands of indurated shale, enclosing plant-remains and irregular coal-seams, which have been included in the next group as its upper member.

The Putataka beds are of marine origin, and contain Middle Oolite fossils, of which eleven species have been identified.

The *Flag Hill series*, which is principally developed in the Hokanui Range, Southland, is marine, and is characterized by eighteen forms of fossil shells which have been identified, besides many others which have yet to be examined.

The Brachiopoda are interesting, as, besides seven forms of *Rhynchonella* and three of *Terebratula*, *Spiriferina rostrata*, of the Lias, is abundant, and also a form of *Epithyris* (*i.e.*, a *Terebratula* of the type *T. elongata*), which is not hitherto recorded higher than of Permian age.

The distribution of these beds, as at present known, is confined to the Hokanui Ranges, and a block of country on both sides of the Waikawa River, and extending inland to the Mataura Falls, as well as a narrow strip on Catlin's River, in Southland; a small patch at Amuri Bluff; another at Kawhia and the Waikato Heads; and a strip of country running from Raukokore, in the Bay of Plenty, in the direction of Waikaremoana Lake.

The minor subdivisions of these beds have as yet only been made in the Hokanui Ranges.

IX. Lias.

Catlin's River and Bastion series.

This formation consists in its upper part of conglomerates and sandy grits, with plant-remains too indistinct for identification; and in the lower of marly sandstones in banded layers of different colours, at the base having a concretionary structure, which has led to their being termed the "cannon-ball sandstone:" similar sandstones also occur in the Otapiri formation.

Fossils are plentiful, and divide the strata into distinct horizons, *Ammonites* being specially common. Fifteen species of fossils have been determined, but a large number of others are present which have not yet been identified.

The general facies of the Fauna is on the whole Liassic, although

many Lower Oolite forms occur; but the Brachiopoda, of which twenty-one forms have been provisionally distinguished, again present the same abnormal survival of older types, especially in the occurrence of an *Athyris*-like shell belonging to a new sub-genus, *Clavigera*, which has a great development in the next lower formation.

Our knowledge of this formation in New Zealand is confined to the Hokanui Range and the country between Gore and the sea-coast at the mouth of Catlin's River; but no doubt, when the Lower Mesozoic formations are examined in detail elsewhere, the Liassic strata will be found to have a much greater development than is at present ascribed to them.

X. Trias.

a. *Otapiri series.*
b. *Wairoa series.*
c. *Oreti series.*

It has been found necessary to include in this formation a thickness of strata which is quite unusual in other parts of the world; but the close connection which exists throughout, founded on both palæontological and stratigraphical grounds, and the clearly-defined Permian character of the next underlying formation, renders this classification absolutely necessary.

The *Otapiri series* consists of a group of strata which I place in the Upper Trias, or more properly as an equivalent of the Rhætic formation, and is remarkable for the mixed character of its fossils, which however contain many forms identical with those from the Rhætic formation of the European Alps.

This mixed character is shown by the presence of *Belemnites otapiriensis*, which is near to *B. elongatus* of the English Lias, along with *Pleurotomaria ornata*, and *Tancredia truncata*, which are Oolite forms, associated with a preponderance of Triassic and even Permian forms, fourteen species of which have been determined, amongst which are *Nautilus mesodiscus* and *Nautilus goniatites*, Cephalopoda found in the Hallstadt or Rhætic beds of Europe.

The remarkable feature of the Otapiri series is the abundance of Brachiopoda, which are elsewhere so rare in formations of this period; but, as might be expected, they are chiefly peculiar forms—*Clavigera*, which has seven species, representing the genus *Athyris*; and a sub-genus of *Spiriferina*, which I name *Rastelligera*, with five species, being almost entirely confined to this formation. Plant-remains also occur.

The *Wairoa series* has been generally admitted to be Trias since it was first described by Dr. von Hochstetter as characterized by *Monotis*

salinaria, Halobia lomelli, &c. Eleven species have now been determined, and Brachiopoda are represented by the earliest appearance of *Clavigera, Rastelligera,* and a form allied to *Spiriferina* but having the dental plates conjoined with the rostral septum *(Psioidea).*

In some districts the Wairoa series is divided into two horizons, yielding marine fossils, separated by sandstones containing fossil plants, from which forms of *Glossopteris, Zamites,* and *Rhacophyllum* have been obtained.

The *Oreti series* (formerly included in the Lower Wairoa series) includes a great formation of green and grey tufaceous sandstones and breccias, having at its base a remarkable conglomerate of enormous masses of crystalline rocks, in a hard cementing matrix, resembling the character described for the base of the Gondwinda series in India. Some of the blocks, which are both angular and rounded, are 5 feet in diameter. This conglomerate has a thickness varying from 50 feet to 400 feet, and is never absent from its proper sectional position in any part of the Hokanui District. These strata have been sometimes termed "ash-beds" on account of their tufaceous and brecciated character.

The fossils are chiefly Permian and Triassic forms, but a *Pentacrinus* also occurs, which resembles the Jurassic species. Brachiopoda are scarce, except one form of true *Athyris,* of which specimens are very abundant; also two species of *Psioidea,* and four species of *Rhynchonella* with smooth external surfaces, which only occur in collections from these beds in the Kaihiku Ranges.

These Triassic beds are best known in the Moonlight and Hokanui Ranges in Southland, and extending as a narrow strip to the sea-coast at Nugget Point. They also occur at the Wairoa Gorge, in Nelson, where they were first discovered by Dr. von Hochstetter; but they are also found in the Jollie Range, at the head waters of the Rakaia and Rangitata Rivers; bounding the Hanmer Plains and forming the Lowry Peaks; and also at the mouth of the Dillon River, and at the gorge of the Ashley, where the limestones are highly fossiliferous.

In the North Island they occur in the vicinity of Wellington, and also between Cape Palliser and Palliser Bay; and are found, farther north, flanking the western side of the Hakarimata Range, where the Raglan track crosses it. The boundaries of these beds, except in Southland and at the Wairoa, may yet require modification, but in the above places the beds have been traced with considerable care.

XI. Permian.

Kaihiku series.

The mineral character of this formation is grey and green sand-

stone with breccia and heavy conglomerate beds. Marine fossils have only been found at 1,000 feet below the great conglomerate that divides it from the Oreti series, the lower 5,000 feet not having yet been discovered to be fossiliferous.

The leading fossils are Permian species, of which a large number have been recognized, and the greater number which have been found in Southland also occur at Mount Potts in Canterbury, and also in Nelson, where beds of the same age are present. *Trigonotreta undulata* is a common and characteristic form.

Saurian remains are associated with these beds at Mount Potts, which in 1871 I referred to *Ichthyosaurus*, but have since referred to the genus *Eosaurus* of Marsh. The further remains obtained of this Saurian are, however, of such gigantic size as compared with the original types found in Nova Scotia, in which the vertebræ were only 2½ inches in diameter, that the determination may be doubted.

It is worthy of note that from a formation of the same age, near Nugget Point, Otago, and also in the Otapiri series in the Wairoa district, Nelson, teeth having *Labyrinthodont* characters have been obtained.

The occurrence of these Saurian remains, together with the survival of many Permian forms into the Wairoa and even the Otapiri series, and the absence of true *Spirifera, Productus,* and other usual Palæozoic elements of a Permian Fauna, would seem to connect the Kaihiku series rather with the Mesozoic than the Palæozoic formations of New Zealand.

At the base of the Kaihiku series are the *Glossopteris* beds of Mount Potts, but these were not found in the Hokanui section, although from the thickness of the strata the relative beds must be included in it, while in the Kaihiku district *Glossopteris* occurs in the lower beds as developed in Popotunoa Gorge.

The distribution of these beds, so far as at present proved by fossils, is confined to the South Island, where they have been recognized in the Hokanui Ranges, extending from there to the coast at Nugget Point; in Mount Hamilton; and in the Mount Potts district, where they cover a considerable area, included between two belts of Carboniferous rocks in that district; and they are found again as a small patch in the Wairoa district of Nelson.

XII. Lower Carboniferous and Upper Devonian.

a. *Maitai series.*

b. *Te Anau series.*

This formation is of considerable importance from the large share it takes in the structure of the great mountain-ranges, and from the

occasionally great development in it of contemporaneous igneous rocks, with which are associated metalliferous deposits. In the upper part this formation consists of fine-grained argillaceous slates (Maitai slates of Hochstetter), becoming calcareous and passing into true limestones at their base. These limestones, which close the Maitai series, contain the following Lower Carboniferous fossils: *Spirifera bisulcata, S. glaber, Productus brachythærus, Cyathophyllum,* and *Cyathocrinus.*

Succeeding these is the Te Anau series, which should probably be considered as Upper Devonian, but from the absence of fossils it has not been distinguished on the map.

It comprises an enormous thickness of greenstone breccias, aphanite slates, and diorite sandstones, with great contemporaneous flöes and dykes of diorite, serpentine, syenite, and felsite.

These beds occur in the Longwood Range; the Takitimu Mountains; and between the mouth of the Molyneux River and Martin's Bay, occupying the area between the Te Anau and Wakatipu Lakes.

In Northern Otago and Canterbury they form a continuous belt of country from Palmerston to Mount Cook, embracing the whole of the Mackenzie country; from there north they are found in the Tyndall Range; at Browning's Pass; the Spencer Mountains; St. Arnaud Mountains; thence through Nelson to D'Urville Island; and, taking in a large area of the Marlborough District, they reappear from below the Permian rocks in the Kaikoura Mountains. They are also found on the eastern side of the Permian rocks at Geraldine; Mount Peel; the Palmer Range; Big Ben Range; Okuku Range, crossing the Hurunui River, and appearing on the edge of the Hanmer Plains. They are again seen in the Paparoa Range at Greymouth, and extend from a point a little west of Mount Herschel, through Reefton and Lyell, to the Tasman Mountains and Anatoki Range, near Collingwood. At Reefton they are the matrix of the auriferous reefs in that important mining district, and are distinctly seen to rest unconformably upon richly fossiliferous limestones and quartzites of Lower Devonian age. The auriferous cements which are worked at Reefton belong to the coal-bearing formation of the West Coast, which is of Cretaceous age.

In the North Island their principal development is through the Rimutaka, Tararua, Ruahine, and Kaimanawa Ranges, and thus on to the Whakatane country, where they reach the sea-coast between Opotiki and Kotiki Point. They also occur as several isolated patches more to the westward, between Tuhua and Rangitoto; in the Hakarimata, Pataroa, and Wairoa Ranges; in the gorge of the Waikato above Cambridge; again at the Thames and Cape Colville Peninsula;

and, appearing once more at Whangarei, extend from there along the coast-line to the Bay of Islands, also appearing in the same district as several isolated patches.

XIII. Lower Devonian.

Reefton beds.

These, as determined by their fossil contents, have only been distinguished in one locality, viz., Reefton, although from their mineral character they are evidently present in many other parts of the South Island.

They consist of alternating beds of quartzite, chert, and limestone, the latter yielding many fossils, of which *Spirifera vespertilio* and *Homalonotus expansus* are the most characteristic forms.

XIV. Upper Silurian.

Baton River series.

A great part of the area coloured on the map as metamorphic schists should probably be included in this formation, but it has only been distinguished by its fossil contents in the north-west district of Nelson, where both Upper and Lower Silurian rocks are present.

The Upper Silurian rocks consist of grey cherts, sandstones, and calcareous slates, with occasional beds of blue limestone.

In the Baton River they contain a great variety of fossils in the calcareous strata, and not infrequently in the sandstones and cherts, of which thirteen species have been determined, besides which a great variety of corals and corallines occur; crinoids also are very abundant.

Some few of the species are identical with those found in the Lower Devonian beds of Reefton, whilst others occur in the Lower Silurian rocks of America, but the prominent facies of the collections is undoubtedly Upper Silurian. The characteristic fossils are *Spirifera radiata, Stricklandia lyrata, Pterinea spinosa, Murchisonia terebralis,* and *Calymene blumenbachii.*

XV. Lower Silurian.

Mount Arthur series.

These rocks form the mass of Mount Arthur and the range to the north-east as far as Separation Point, and they consist chiefly of a dark bituminous slate, associated with a blue or grey submetamorphic limestone, which is in places developed to a very large extent. White crystalline limestones are also associated with these beds throughout the whole length of the district from Mount Owen to Motueka.

The whole series is disturbed by eruptive hornblendic and syenitic rocks, which are probably of Devonian age.

Fossils have been found in two localities only, and these consist entirely of Encrinite remains, one species of coral not yet determined, and a few Graptolites which occur in the slates.

The central axis of these beds consists of true mica-schists, to the east and west of which the limestone and bituminous slates overlie.

XVI. Foliated Schists.

The metamorphic rocks under this division have as yet been only subdivided according to their mineral character; but they probably consist chiefly of altered Silurian rocks, and even those of formations as young as the Maitai or Lower Carboniferous beds. The less metamorphosed areas of Lower Palæozoic rocks in the South of New Zealand have yielded no fossils. They were formerly classed as the Kaihiku series, but this name has latterly been transferred to the Permian formation of which the Kaihiku Range is more largely composed.

The schists occupy the central portion of the Otago District, where they have an area of nearly 8,000 square miles, and thence they crop out along the western flank of the central range through Westland and Nelson, a detached area also appearing in the Marlborough District, between Queen Charlotte Sound and the Pelorus. They are unknown in the North Island.

They have been subdivided as follows :—

Upper (Kakanui series).—A grey arenaceous and slaty rock, containing a little quartz in the form of veins and laminæ, with fine-grained quartz breccias and roofing slates, and having massive beds of crystalline limestone locally developed.

Middle.—Soft blue slates, often highly micaceous, and intersected with quartz veins of small size, the quartz being often rotten and decomposed. The thickness of this formation is not more than from 500 to 1,000 feet, and it is probably from this formation that most of the gold in the western or lake gold fields has been derived, by the direct erosion of glaciers and mountain-torrents. This blue-slate formation has been removed by denudation from the greater part of the central anticline of Otago, only remaining in a few localities that are difficult of detection on account of its soft and perishable nature.

Lower Contorted Schist.—This is a clay-schist, foliated, not with mica nor felspar, but with quartz. It is often chloritic, when veins of magnetite occur in it, and also crystals of that mineral disseminated through the mass; and in the upper part the quartz is nearly wanting.

The schists, apparently, lie very flat, and cover a great extent of country. The foliated quartz does not commence at a distinct horizon, but beds thus altered occur in the regular sequence of the strata,

separated by quartzless rock: in the lower part of the series, however, as exposed in the deep valleys that cut right through the central district of Otago, the whole mass of schist is intersected by concretionary laminæ of quartz (generally of a bluish tinge and horny appearance) that conform to the planes of foliation as in mica-schist. Gold occurs segregated in the interspaces of this contorted schist, but it is rarely found *in situ*. Quartz reefs are confined to the upper schists, but there are but few instances of any other than true fissure-reefs having been discovered, that is, reefs that cut the strata nearly vertically, and have a true "back" or wall independent of the foliation-planes, and filled with brecciated material.

XVII. Crystalline Schists.

The south-western portion of the District of Otago is composed of crystalline rocks, forming lofty and rugged mountains, of which the chief characteristic is their cubical form, due to their being intersected in all directions by profound but narrow valleys, with abrupt precipitous sides to three-fourths of the extreme height of the adjacent mountains. The valleys are occupied on the west by arms of the sea, and on the east by those of inland lakes that resemble the Norwegian fiords, and present most wonderful mountain scenery.

The base rock of this formation is foliated and contorted gneiss corresponding to Humboldt's gneiss-granite of South America, and associated with it are granite, syenite, and diorite, which belong to the next group.

Wrapping round these crystalline strata, and sometimes rising to an altitude of 5,000 feet on its surface, is a series of hornblende schists, soft micaceous and amphibolic gneiss, clay-slate, and quartzites, associated with felstone dykes, serpentine, and granular limestone. I believe these latter to be metamorphic rocks of not very ancient date, probably of Devonian age.

XVIII. Granite.

Areas within the crystalline schists where true granite occurs, either metamorphosed or in the form of perfect dykes, have been distinguished under this group.

Granites of a light-grey colour and very fine grain are found in the Nelson and Westland Districts, forming isolated hills along the boundary of the Foliated Schists on the east and Lower Devonian beds on the west. In the south-western extremity of New Zealand, at Preservation Inlet, coarsely crystalline granites, of white and flesh-colour, appear to break through and overlie the younger members of the crystalline schists.

Igneous Rocks.

XIX. Plutonic and Dyke Docks.
XX. Basic Volcanic Rocks.
XXI. Acidic Volcanic Rocks.

Or, if grouped according to age, as in the geological sections,—

A. Volcanic group. Recent and Post-tertiary.
  a. Basaltic.
  b. Rhyolitic.
B. Trachytic group. Eocene.
  a. Trachyte-porphyries.
  b. Trachyte-breccias.
C. Dolerite group. Upper Cretaceous.
  a. Trachy-dolerites.
  b. Anamesites.
D. Propylite group. Lower Cretaceous.
E. Diabase group. Triassic.
F. Diorite group. Lower Carboniferous.

The igneous rocks have played an important part in almost every formation in New Zealand, marking great movements of the earth's crust at the different geological periods, while the superficial and later-formed volcanic rocks occupy nearly one-third of the area of the North Island.

They are divided on the map into the above groups, of which the plutonic and dyke rocks include syenite and diorite, with associated breccias, serpentine, and olivine rocks (dunite), the eruption of which took place in the Upper Devonian period.

These rocks are found on a line which extends almost continuously through the South Island; but diorite rocks reappear in the extreme north of Auckland, and on the Cape Colville Peninsula and Great Barrier Island. They are generally more or less metalliferous, chrome and copper being the ores of most frequent occurrence.

Basic Volcanic Rocks.—These belong to three distinct periods, when there were active eruptions, attended by the formation of flöes of both compact igneous rocks and tufaceous breccias.

The earliest of these occurred during the Triassic period, and consists chiefly of diabase and serpentinous breccias. The next eruptions took place about the close of the Jurassic period, along the eastern base of the Canterbury Alps, where the rocks occur in dome-shaped mountains as melaphyres associated with felsite (quartz) porphyries which belong to the next group.

In the Cretaceo-tertiary period are massive trappean eruptions of trachy-dolerite and dolerite, while in the same period must be placed the propylite group, consisting of greenstone-trachytes, and fine- and

coarse-grained breccia rocks, which form the matrix of the auriferous reefs of the Thames gold fields.

In Eocene times dolerite flöes were contemporaneous with the limestones of the period of the Hutchinson's Quarry beds, while lastly in this group have been placed the basaltic lavas of Pliocene age in the northern parts of the colony, and also certain dykes of vesicular lava that cut through and alter the Upper Pliocene gold-drifts in the Maniototo Plain, in the interior of Otago.

Acidic Volcanic Rocks.—The rocks belonging to this group have a similar distribution in time to the foregoing, the earliest being the felsite (quartz) porphyries, while trachyte porphyries and breccias played an important part during Cretaceo-tertiary and older Tertiary periods, scoriaceous lavas and rhyolites being the characteristics of the later outbursts, which have continued down almost to the present time.

The geysers and boiling springs in the North Island give rise to the formation of siliceous sinter, which must be included as the most purely acidic products of volcanic action, and as due to the decomposition of the older rocks by the action upon them of fresh water; but in the case of White Island, and other localities where the decomposition is brought about by the agency of sea-water, the sinter deposits are formed chiefly of sulphate of lime, and not silica.

MINING AND GEOLOGY: ECONOMIC MINERALS.

Coal.

Coal mines are being worked in the Provincial Districts of Auckland, Nelson, Canterbury, and Otago (including Southland).

The different varieties of coal may be classed as follow:—

Class I.—*Hydrous,* containing an excess of combined water.
- Lignite.
- Brown coal.
- Pitch coal.

Class II.—*Anhydrous,* containing very little combined water.
- Glance coal.
- Semi-bituminous coal.
- Bituminous coal.

I. Hydrous Coal, containing 10 to 20 per cent. of permanent Water.

Lignite shows distinctly woody structure; laminated; very absorbent of water.

Brown Coal rarely shows vegetable structure; fracture irregular, conchoidal; colour dark-brown, lustre feeble; cracks readily on ex-

posure to the atmosphere, losing 5 to 10 per cent. of water, which is not reabsorbed; burns slowly; contains resin in large masses.

Pitch Coal.—Structure compact; fracture smooth, conchoidal; jointed in large angular pieces; colour brown or black, lustre waxy; does not desiccate on exposure, nor is it absorbent of water; burns freely; and contains resin disseminated throughout its mass.

II. ANHYDROUS COAL, containing less than 6 per cent. of Water.

Glance Coal.—Non-caking, massive, compact or friable; fracture cuboidal, splintery; lustre metallic; structure laminated; colour black; does not form a caking coal, but slightly adheres. This variety is brown coal altered by igneous rocks, and presents every intermediate stage from brown coal to anthracite.

Semi-bituminous Coal.—Compact, with laminæ of bright and dull coal alternately; fracture irregular; lustre moderate; cakes moderately, or is non-caking.

Bituminous Coal.—Much-jointed, homogeneous, tender and friable; lustre pitch-like, glistening, often iridescent; colour black with a purple hue, powder brownish; cakes strongly, the best varieties forming a vitreous coke, with brilliant metallic lustre.

General Description.

Class I.—The *Hydrous Coals* of the South Island occur on the eastern coast chiefly.

Pitch Coal has been worked since 1867 at West Wanganui, in Nelson; and in Otago at Shag Point, forty miles north of Dunedin, it has been worked since 1862, together with brown coal. It is also found at Reefton, Nelson, where it contains resin disseminated throughout its mass; Waikato and Whangarei, Auckland; Morley Creek, Southland. It belongs to the Upper Cretaceous period, and has an evaporative power of 5·2 lb.

Brown Coal is extensively worked in Auckland, on the Waikato River, and in the Kaitangata Mine, Clutha district of Otago, where the seams are from 5 to 20 feet thick. The area of this latter coal field is about 6,000 acres, and the quantity of coal has been estimated from surveys to be 140,000,000 tons, nearly the whole of which would be available without sinking. In the same provincial district thick seams of brown coal in grits and clay-shale have been worked since 1861 at Green Island and Saddle Hill, and extensive seams exist in Southland, and to the west of Riverton, which have not yet been regularly mined. It belongs to the age of the Upper Greensand, and has an average evaporative power of 4·2 lb. to 5·6 lb.

The *Lignites* of Lower Miocene age occur in the interior of Otago

and at other places in superficial deposits of limited extent, and have been used chiefly by gold-miners.

Class II.—The *Anhydrous* kinds of coal prove to be quite equal to any imported, experiments having been undertaken in 1865 for ascertaining their value as steam coals. Both these and the hydrous coals occur at the base of a great marine formation, underlying limestone, clays, and sandstone of Cretaceous and Tertiary age, which have a thickness of several thousand feet, the coal-seams occurring whenever the above formation is in contact with the basement rock. The anhydrous kinds are more limited in distribution, and appear to have been produced by local disturbance of the strata, and in some cases are evidently due to the intrusion of volcanic rocks.

Bituminous Coal is worked chiefly in the Nelson District. At Mount Rochfort or Buller mines the seams are on a high plateau, and are 10 to 40 feet thick, and from 900 to 3,000 feet above sea-level. Accurate surveys of this coal field show it to contain 140,000,000 tons of bituminous coal of the best quality and easily accessible. A Government railway seventeen miles in length is now completed along the level country at the base of the ranges in which the coal occurs, and from which it is lowered by incline planes constructed by the coal-mining companies. The principal mine is the Banbury, which has a magnificent seam of hard bituminous coal at an altitude of 1,800 feet above the sea-level. At the Brunner coal mine, on the Grey River, Nelson, the working face of the seam is 18 feet, and it has been proved to extend one-third of a mile on the strike without disturbance, and to be available for working in an area of 30 acres, the estimated amount of coal being 4,000,000 tons in this mine alone, most of which can be worked above the water-level. Coal-Pit Heath is a second mine lying more to the dip of the same seam. A third mine is being opened on the south side of the river, which, with a 370-feet shaft, will command 300,000 tons. The coal from the Brunner Mine, Nelson, which has now been worked for twelve years, yields vitreous coke, with brilliant metallic lustre. Average evaporative power of several samples, 7½ lb. of boiling water converted into steam for each pound of coal. It occurs with grits and conglomerates of Upper Mesozoic age, corresponding to the horizon of the Gault or Lower Greensand. A railway has been constructed by Government to connect the mine with the port, and harbour improvements are in progress, whereby a larger class of vessels than at present will be enabled to enter the river. The small quantity of this coal hitherto obtainable in New Zealand and Australian markets has been eagerly bought up for gasworks and iron foundries, which generally pay for it from 10 to 20 per cent. more

than for any other coal. Engineers of local steamers esteem it 20 per cent. better than the best New South Wales coal for steam purposes. Coke made from it is valued at £3 per ton.

Coal fields in other parts of the Nelson District have also yielded excellent coal. At Murray Creek, Inangahua, an 18-feet seam of semi-bituminous coal is worked, associated with quartz grits. At Pakawau, and in the same formation at Collingwood, thin seams of hard bright bituminous coal have been worked from the sandstones of the Cretaceous period. The area of the coal field is about thirty square miles, and the facilities of access and shipping and the abundance of iron ore and limestone will probably make this an important mining district. The chief coal mine has been opened by a tunnel 700 feet in length, piercing the mountain at 600 feet above the flats along the Aorere River, the coal being brought down by a self-acting incline. This description of coal also occurs in the irregular seams in sandstone of Upper Mesozoic age (Jurassic and Lower Cretaceous), at Kawakawa and Whangarei, Auckland; Mount Hamilton and Waikawa, Otago. It rarely cakes strongly, and has commonly an evaporative power of 6½ lb.

Coal has been worked since 1865 in Auckland at the Kawakawa mine, Bay of Islands, from a seam 13 feet thick under a roof of greensand; it contains much sulphur. A similar quality of coal is also worked at Walton's mine, and at the Kamo mine, Whangarei Harbour; and several important mines are opened in the coal-seams at the Malvern Hills, Canterbury.

Glance Coal.—This description of coal does not form a caking coke, but slightly adheres, and is a variety of brown coal, altered by faulting or by igneous rocks, and presenting every intermediate stage from brown coal to an anthracite. Occurs at Preservation Inlet and Malvern Hills, of Lower Cretaceous age, in extensive but detached seams from 2 to 6 feet thick in micaceous and argillaceous shales.

Coal Workings.

The first export of coal from New Zealand was made in 1866, amounting to 261 tons.

The following table shows the relative quantities of coal raised in the colony and imported during the four years ending on the 31st December, 1881 :—

	Raised in the Colony.	Imported.
1878 ...	162,218 tons ...	174,148 tons.
1879 ...	231,218 „ ...	158,076 „
1880 ...	299,923 „ ...	123,298 „
1881 ...	337,262 „ ...	129,962 „

The following is a list of the principal collieries, and the yield of each, for the year ending on the 31st December, 1881 :—

Working Coal Mines in New Zealand.

Number.	Name of Mine and Locality.	Number of Years working.	Quality of Coal.	Number of Seams worked.	Thickness of Seam.	Output for 1881.	
						Coal.	Slack.
					Feet.	Tons.	Tons.
	Kawakawa District.						
1	Kawakawa, Bay of Islands ...	17	semi-bit.	1	4′ to 15′	50,277	...
2	Kamo, near Whangarei ...	5	brown	1	5′ to 12′	10,178	...
3	Whauwhau, near Whangarei ...	17	brown	1	5′ to 9′	2,084	...
	Waikato District.						
4	Huntly, Taupiri	6	brown	2	6′ to 40′	20,334	...
5	Huntly, Kupakupa, Waikato ...	5	brown	1	10′ to 18′	7,860	...
	Pelorus District.						
1	Picton, Picton	1	...	...	...	75	...
2	Picton, Picton	1	...	...	...	...	...
	West Wanganui District.						
3	Wallsend, Collingwood ...	13	bitum.	2	27″ to 32″	nil	
	Westport District.						
4	Mokihinui, Mokihinui ...	1½	pitch	2	6½′ to 7′ 3½″	...	...
5	Koranui, Waimangaroa, Westport	1	bitum.	...	...	nil	
6	Banbury, Waimangaroa ...	3	bitum.	1	4′ 6″	21,693	2,505
7	Energetic, Reefton	6	pitch	1	10′ 2″	852	...
8	Golden Treasure, Reefton ...	10	pitch	1	6′	270	...
9	Lankey's Gully, Reefton ...	...	pitch	1	11′	310	...
10	Newcastle, Reefton	7	pitch	1	9′	nil	
11	Dudley, Reefton	8	pitch	1	21″	150	20
12	Golden Fleece, Reefton ...	11	pitch	1	16′	...	...
13	Dugan's, Reefton	...	pitch	2	23″, 1″ to 8″	200	70
14	Burke's, Reefton	...	pitch	1	10′	100	30
15	Brunner, Greymouth ...	17	bitum.	1	12′ to 16′	25,436	6,045
16	Coal-Pit Heath, Greymouth ...	5	bitum.	1	16′	13,957	1,912
	Greymouth District.						
17	Wallsend, Greymouth ...	5	bitum.	1	16′	nil	
18	Wallsend No. 2, Greymouth ...	5	bitum.	1	17′	3,000	369
	Malvern District.						
19	Springfield, Springfield ...	2	brown	2	4′, 7′ 6″	11,127	801
20	Smithfield, Springfield ...	1	brown	3	4′, 1′, 2′ 3″	1,200	...
21	Kowai Pass, Springfield ...	2½	brown	3	19″, 9″, 18″	693	...
22	Canterbury, Sheffield	19	brown	2	2′ each	2,514	40
23	Homebush, South Malvern ...	9	brown	2	3′, 7′	5,763	260
24	Hart's, South Malvern ...	...	altered brown	3	18″, 18″, 22″	350	
25	Wallsend, South Malvern ...	5	brown	3	3′ each	nil	
26	Brockley, South Malvern ...	2½	alt. brn.	1	3′ 6″	2,480	...
27	Dudley, South Malvern ...	½	...	5	thin	nil	
28	Rockwood, South Malvern ...	1	alt. brn.	1	9″	nil	
29	Lee's, South Malvern	1	brown	1	6′	100	...
30	Mount Somers, Mount Somers ...	16	brown	1	25′	...	...
	Timaru District.						
31	Kakahu, Geraldine	1½	brown	1	8′		
	Otago District.						
32	Wharekuri, Wharekuri ...	15	brown	1	25′	300	...
33	Kurow, Kurow	2	brown	1	8′	205	40
34	Prince Alfred No. 1, Oamaru ...	...	brown	2	9′	925	...
35	Prince Alfred No. 2, Oamaru ...	5	brown	2	9′	1,760	...

WORKING COAL MINES IN NEW ZEALAND—*continued.*

Number.	Name of Mine and Locality.	Number of Years working.	Quality of Coal.	Number of Seams worked.	Thickness of Seam.	Output for 1881.	
						Coal.	Slack.
	OTAGO DISTRICT—*continued.*				Feet.	Tons.	Tons.
36	St. Andrew's, Oamaru ...	3	brown	1	6′ 6″	224	...
37	Ngapara, Ngapara	3	brown	1	25′	861	...
38	Glenfield, Herbert	1	brown	1	6′	210	...
39	Shag Point, Palmerston ...	19	pitch	1	7′	28,673	1,336
40	Hill's Creek, Hill's Creek ...	17	lignite	1	30′	20	...
41	Idaburn, Rough Ridge ...	11	lignite	1	23′	1,023	...
42	Mount Ida, Upper Kyeburn ...	2	lignite	3	9′	nil	
43	Dunsmuir's, St. Bathan's ...	15	lignite	2	12′ to 18′	190	...
44	Crossan's, Naseby	...	lignite	1	9′	85	...
45	Cambrian, St. Bathan's ...	...	lignite	1	25′	1,652	...
46	Swineburn, Kyeburn	2½	lignite	1	...	67	...
47	Last Chance, Hyde	2	brown	1	13′	54	...
48	Kyeburn, Kyeburn	8	brown	3	25′	1,195	...
49	Perseverance, Kyeburn ...	3	lignite	3	6′ to 16′	730	...
50	Alexandra, Alexandra South ...	...	brown	1	14′ to 15′	730	...
51	Manuherikia, Alexandra South ...	3	brown	1	12′	400	...
52	Perseverance, Cromwell ...	2	brown	1	6′ to 7′	248	...
53	Bannockburn, Cromwell ...	...	brown	1	12′	936	312
54	Kawarau, Cromwell	4	brown	1	5′ 6″	650	...
55	Clyde (Collins's), Clyde ...	10	brown	1	20′	860	...
56	Clyde (Holt No. 1), Clyde ...	...	brown	...	...	nil	
57	Clyde (Holt No. 2), Clyde ...	1	brown	1	20′	92	...
58	Earnscleugh, Clyde	5	brown	1	16′	525	...
59	Gibbstown, Arrow	...	brown	1	...	1,200	300
60	McPherson's, Roxburgh ...	...	lignite	1	25′	482	20
61	Low and Robertson's, Roxburgh ...	18	lignite	1	28′	750	190
62	Crossan's, Roxburgh	12	lignite	1	28′	20	...
63	Fernhill, Green Island ...	4	brown	1	19′ 6″	3,956	520
64	Allandale, Green Island ...	1	brown	1	13′	142	...
65	Green Island, Green Island ...	9	brown	1	14′	4,570	1,248
66	Saddle Hill, Green Island ...	7	brown	1	19′ 6″	5,052	...
67	McLachlan's, Green Island ...	¼	brown	1	...	nil	
68	Walton Park, Green Island ...	11	brown	1	18′	16,150	3,770
69	Abbotsroyd, Green Island ...	6	brown	1	16′	8,069	3,086
70	Abbotsroyd No. 2, Green Island ...	½	brown	1	...	...	...
71	Hurdstone, Milton	2	lignite	1	9′	35	...
72	Marshall's, Milton	1	lignite	1	7′	nil	
73	Bruce, Milton	7½	pitch	1	12′ 6″	996	...
74	Real Mackay, Milton	13½	pitch	1	25′	900	...
75	Cannon's, Milton	11	lignite	1	20′	450	...
76	Bryce's, Milton	3	lignite	1	12′	150	...
77	Elliott Vale, Milton	...	pitch	1	20′	540	...
78	Benhar, Stirling	17	brown	1	40′	4,400	...
79	Kaitangata, Kaitangata ...	6	pitch	1	24′	10,318	4,806
80	Kaitangata No. 1, Kaitangata ...	4	pitch	1	30′	17,723	3,296
81	Wangaloa, Kaitangata ...	1	pitch	1	10′ 6″	160	50
82	Johnston, Johnston	7	lignite	1	18′	317	...
83	Wyndham, Wyndham ...	4	lignite	1	6′	269	...
84	Dawson's, Gore	4	lignite	1	6′	91	...
85	Sarginson and Telfer's, Gore ...	3½	lignite	1	8′	60	...
86	Chittock's, Gore	5	lignite	1	9′	nil	
87	White's, Gore	5	lignite	1	9′	nil	

WORKING COAL MINES IN NEW ZEALAND—*continued.*

Number.	Name of Mine and Locality.	Number of Years working.	Quality of Coal.	Number of Seams worked.	Thickness of Seam.	Output for 1881.	
						Coal.	Slack.
					Feet.	Tons.	Tons.
	OTAGO DISTRICT—*continued.*						
88	McKinnon's, Gore	6	lignite	1	6′	45	60
89	Chatton, Chatton	5	lignite	1	...	260	...
90	Harker's, Waikaka	4	lignite	1	...	150	...
91	Elliott's, Wyndham	1	lignite	1	6′	179	...
92	Heffernan's, Gore	1	lignite	1	15′	150	...
93	Pukerau, Pukerau	2	lignite	1	20′	1,270	...
94	Pukerau, Pukerau	3	lignite	1	15′	1,179	...
	SOUTHLAND DISTRICT.						
	Mataura, Mataura	6	lignite	1	12′ 6″	611	...
	Mataura, Mataura	6	lignite	1	12′ 6″	1,380	...
97	Templeton's, Wyndham ...	1	lignite	1	5′	216	...
98	Nightcaps, Otautau	4	pitch	1	5′ to 6′	120	...
99	Knight's, Otautau	1	pitch	1	varies	148	...
						337,262	

The first notable development of the coal fields was due to the great increase in the consumption of the Kawakawa coal, owing mainly to the circumstance that the Union Steamship Company adopted it for their coastal steamers, and reported most favourably of its utility as a steam coal; but now the coal mined near Greymouth and Westport is also largely used for the same purpose.

The total quantity of coal imported during 1878 and 1881 was, from—

	1878.	1881.
New South Wales ...	172,254 tons	127,501 tons.
Other sources ...	1,894 „	2,461½ „
	174,148 „	129,962½ „

The total quantity of coal exported during the same years was, to—

	1878.	1881.
New South Wales ...	400 tons	2,870 tons.
Victoria	3,513 „	2,919 „
South Sea Islands ...	8 „	832 „
	3,921 „	6,621 „

It appears from the table on p. 44 that the total consumption of coal in the colony during four years from 1878 to 1882 has been 1,616,105 tons, of which 1,030,621 tons were derived from New Zealand mines.

It is not at all likely, however, that these figures will long con-

tinue to bear the same relative proportions, there being a fair prospect that the improvements now in progress for affording increased railway transport and better shipping facilities will give such a stimulus to this valuable industry that the output will be sufficient, not only for the supply of a fair portion of the home consumption, but also for a greatly increased foreign trade.

Gold and Silver.

Gold was discovered in 1842, less than three years from the foundation of the colony, but it was not practically worked until 1852, when the mines at Coromandel first attracted attention to the district of Cape Colville Peninsula, which still forms the chief centre of true lode-mining operations in New Zealand. The yield from those mines was up to 1880 over four and a half millions sterling, but is small when compared with the quantity of alluvial gold obtained in the South Island subsequent to 1861, at which date the gold fields of Otago became prominently known. The accompanying diagram illustrates the history of the development of gold-mining in New Zealand as a whole, and in the northern, central, and southern mining districts.

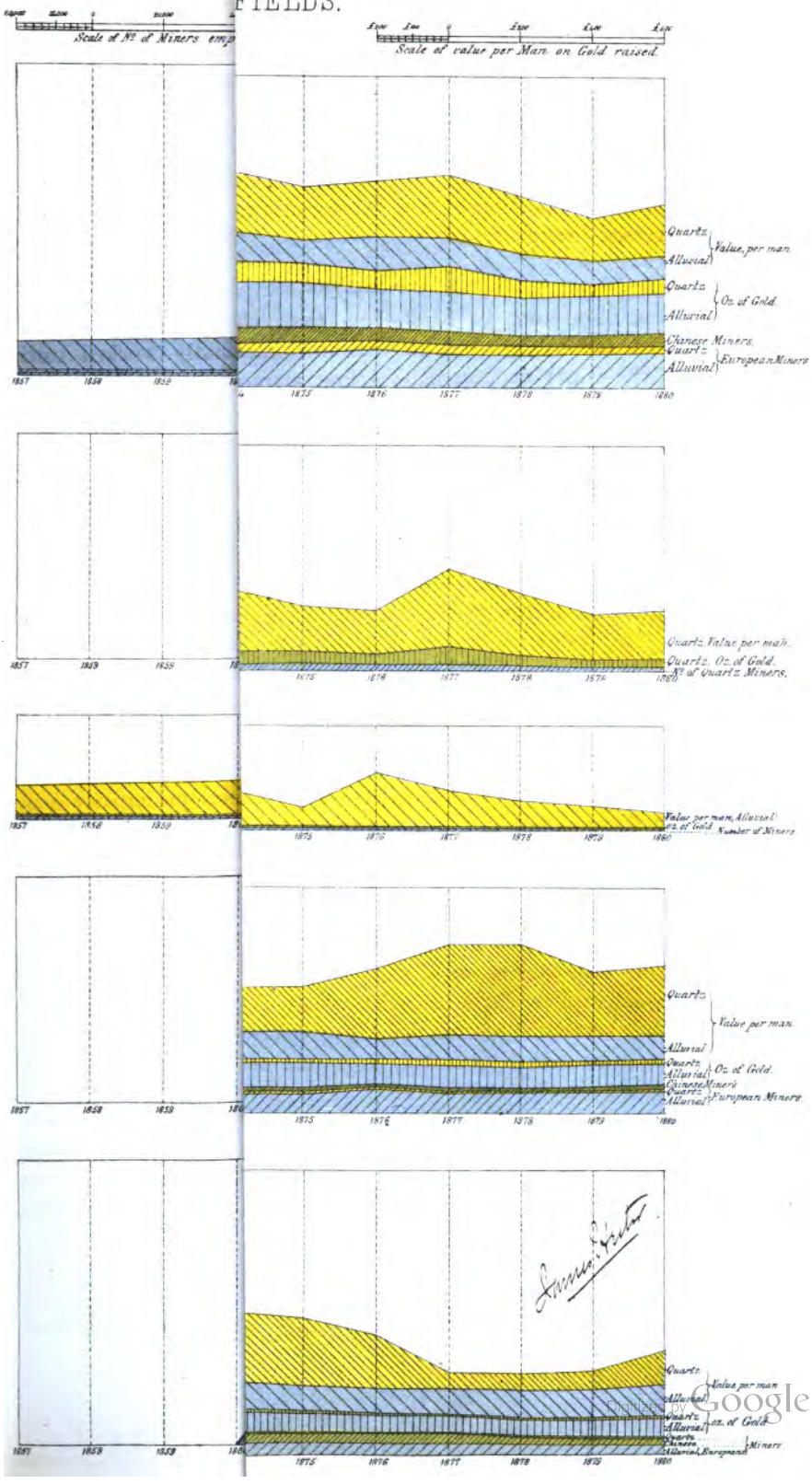
Quartz-mining.

The principal quartz mines in the North are in the Coromandel and Thames districts, about thirty miles apart. In these localities the reefs have been proved to a depth of over 600 feet below sea-level, but the best mines have as yet been principally confined to the decomposed and comparatively superficial rock. Veins have been discovered and gold obtained at all levels on the ranges from the sea-level to an altitude of 2,000 feet. The quantity of gold that has been obtained from some of these quartz reefs is very great, and for considerable distances the quartz has yielded very uniformly at the amazing rate of 600 oz. to the ton: such reefs are, however, very exceptional in New Zealand, as elsewhere. The value of such a yield may be better estimated by those not conversant with the subject, when it is stated that half an ounce to the ton is in most cases a profitable return.

Auriferous reefs are also extensively worked in the schistose rocks of Otago, and they occur at all altitudes, from sea-level to a height of 7,400 feet, the most elevated gold mine in the Australasian Colonies being that opened during the year 1878 on the summit of Advance Peak, near Wakatipu Lake.

Several promising reefs have also been found in the Westland gold fields, amongst which may be mentioned a reef of auriferous stibnite at Langdon's Creek, near Greymouth, which yields from a

FIELDS.



few ounces to 99 oz. of gold per ton; but up to the present time these reefs have not received the attention they deserve, except at Reefton and a few other localities. The importance of Reefton as a well-established mining district may be judged of from the fact that nine mining companies there, during the year ending on the 31st March, 1878, divided, as profit, the sum of £63,508 among the shareholders.

So far as this more permanent form of gold-mining is concerned, there is every reason to feel confident that it is still in its infancy in this colony, and that it only awaits the judicious application of capital for its development to a vast extent.

Alluvial Mining.

Alluvial gold is chiefly found in the South Island, in the Districts of Otago, Westland, and Nelson, in which mining operations are carried on over an area of about 20,000 square miles.

The auriferous sand, or gold drift, as it is usually termed, is of three distinct kinds.

Firstly, that which is found in the beds of rivers, and which is worked by small parties of miners, as the process requires no large expenditure of capital to effect the separation of the gold.

Secondly, immensely thick deposits of gravel of more ancient date occupy the wider valleys and the flat country, from which the gold can only be obtained by means of considerable expenditure and large engineering works for the purpose of bringing a supply of water for undermining and working the auriferous deposits. This description of mining is of a more permanent character than the former, and provision has been made by the Colonial Government for assisting the miners by the construction of water-races, which will supply the means of profitable employment to a much larger number of persons than at present gain a livelihood by it.

Some of these deposits are of considerable age, the cements of Tuapeka being certainly not younger than the lowest Tertiary deposits of the colony. They occur in beds from 300 feet to 500 feet thick, and cover a considerable area of country. These cements are treated in a different way from ordinary alluvial deposits, being crushed and washed in the same manner that a quartz reef is worked; but in consequence of the nature of the deposit as much as 150 tons of stone is put through the batteries in one day. They consist of coarse gravels and silts cemented together, carrying variable quantities of gold, and were first found at the Blue Spur in Otago, and subsequently at a number of other places in the same district. At Charleston also, and elsewhere on the West Coast, auriferous cements are worked, but the localities first cited are those which to the present

time have received the greatest attention. The yield of gold from these cement claims is small, but, in consequence of the large amount of material which can be operated upon, the value of the deposits is considerable, and their extent guarantees that they will afford a remunerative return for some time to come.

Thirdly, along the sea-coast the continued wash of the waves produces a shifting action on the sands which are brought down by the rivers and drifted along the shore, thus producing fine deposits of gold, the extraction of which, by the aid of simple mechanical contrivances, affords employment to a large number of diggers, who can labour without incurring the hardships and privations which attend the occupations of miners in the more inland districts.

The alluvial diggings at Collingwood were discovered in 1858; those of Otago in 1861; and in 1864 the gold fields near Hokitika proved a great attraction to the mining population of New Zealand. In Otago the gold drifts rest on the denuded surface of their parent rocks. The auriferous gravels in the western district on the other hand, as a general rule, rest on the surface of Tertiary rocks of marine origin, and they have a general distribution parallel to whatever was the western shore of the Island at the time of their deposit.

The richest alluvial diggings in Westland usually occur in places very inaccessible for water supply, the streams having cut their channels much below the surface of the country, so that an organized system of irrigation is necessary to obtain the required amount of water for the gold-washing.

The following is the composition of New Zealand gold as exported from various districts :—

Melted gold from West Coast, Hokitika, Westland :

Assay—Gold	... ...	·9627
Silver	... ...	·0363
Copper	... ...	·0010

Melted gold from Thames District, Auckland :

Assay—Gold	... ...	·6565
Silver	... ...	·3390
Copper	... ...	·0045

Refined gold, as extracted by the chlorine refining process, and as exported by the Bank of New Zealand, Auckland :

Assay—Gold	... ...	·9942
Silver	... ...	·0058

The total quantity of gold entered for exportation from New Zealand up to the 31st December, 1881, amounted to 9,822,755 oz., valued at £38,461,423.

Silver and Silver Ores.

The silver exported from the colony has been chiefly extracted from the gold obtained at the Thames, which is alloyed with about 30 per cent. of the less valuable metal.

Within the last few years, however, several mines have been opened where the ore is argentiferous galena that yields 20 oz. to 50 oz. of silver to the ton. In some cases the galena is mixed with iron-pyrites that yields a fair percentage of gold.

A mine was formerly opened in Nelson, at Richmond Hill, where the ore is a form of tetrahedrite, a mixed ore, containing silver, antimony, zinc, bismuth, and copper, the silver being at the rate of from 20 oz. to 1,792 oz. per ton. The following is an analysis of the ore, which has been called Richmondite, after the locality in which it is found :—

Sulphide of lead	36·12
„ antimony	22·20
„ bismuth	traces
„ copper	19·31
„ iron	13·59
„ zinc	5·87
„ silver	2·39
Oxide of manganese	·52

The total quantity of silver entered for exportation from New Zealand from the year 1869, when it was first exported, up to the 31st December, 1881, amounted to 377,471 oz., valued at £99,469.

Iron Ores.

No iron mines are at present worked, though almost every known variety of iron ore has been discovered in the country; the workings being limited to the black sands, which occur plentifully on the coasts. There are also few soils or stream-gravels that will not yield a considerable quantity when washed. The chief deposits are, however, on the sea-shore of the west coast of both Islands, the best known being that at Taranaki.

Several companies have been formed both in England and the colony to manufacture steel direct from this ironsand. They have not, however, succeeded, but a partial success was attained by smelting, in furnaces, bricks formed of the ore with calcareous clay and carbonaceous matter, and recently the sand has been treated by a continuous cementation process that produces puddled blooms. It remains to be proved, however, if it can be profitably treated in large quantities by this or any other process.

Brown Hæmatite Ore.

At Parapara, Nelson, immense quantities of brown hæmatite ore occur on the surface of the ground. Some of this was converted into iron at Melbourne in 1873, and gave, on analysis,—

Iron	97·668
Manganese	·268
Carbon combined	·542
„ free (graphite)	·208
Silicon, with titanium traces	1·004
Phosphorus	·041
Sulphur	·269
	100·000

This iron had the following characters: Colour uniform, approaching white; structure homogeneous, and finely granular, hard, brittle. It is therefore the variety called white iron.

A further valuable deposit of brown hæmatite has been discovered by an officer of the Geological Survey Department on the west side of Mount Peel, where the deposit is about 60 feet thick. The ore contains 56 per cent. of metallic iron, and has been traced for a distance of three miles, beyond which point it is reported to swell out to as much as a mile in width.

The following are the chief localities in which iron ore is found:

Specular Iron Ore.—Dun Mountain, Nelson. Occurs in irregular veins in greenstone rocks; contains 63 per cent. of metallic iron.

Specular Iron Ore.—Maori Point, Shotover, Otago. A 6-foot vein in mica-schist, equally rich with the above; extent unknown.

Compact Iron Ore.—D'Urville Island, Nelson. Vein, thickness unknown, in diorite slate, with serpentine and chrome; yields 63 per cent. of iron.

Magnetic Iron Ore.—This valuable ore, though occurring chiefly as black sand, is found in several parts of the colony in the massive form.

Magnetic Iron Ore.—Dun Mountain, Nelson. In a vein 16 inches thick in serpentinous slates.

Magnetic Iron Ore.—Wakatipu Lake, Otago. In a vein in mica-schists.

Magnetic Iron Ore.—Maramarua, Frith of Thames. From a vein in ferriferous slates; contains only oxides of titanium and manganese.

Black Ironsand.—From beach at Taranaki.

Iron-band Ore.—Contains 70 per cent. of iron. Occurs at Wyndham River, Otago, and Manukau, Auckland; formed by black-sand layers becoming cemented with hæmatite. This would be a most valuable ore if obtained in large quantities.

Brown Hæmatite, or hydrous oxide, also occurs in Amuri in great quantity.

Reniform Iron Ore, Mongonui.

Bog Iron Ore.—Spring Swamp, Auckland. Forms thick layers at the bottom of swamps. Though rich in iron, the ore is inferior on account of the sulphur and phosphorus it usually contains.

Hæmatite.—An analysis of this ore, from Raglan, gave—

Sesquioxide of iron	72·69
Oxide of manganese	·81
Alumina	2·02
Magnesia	·69
Lime	·58
Phosphoric acid	not estimated
Sulphide of iron	·11
Hygroscopic water	4·61
Constitutional water	13·02
Silicates undecomposed by acids	5·97
	100·00

Ironsands.

The following tabular statement gives a particular account of ironsands :—

Locality.	Matrix whence probably derived.	Magnetite.	Hæmatite.	Titanite.	Percentage of Iron.	Other Minerals present.
Upper Buller River, Nelson ...	Hornblende rocks	87·5	9·4	...	70·2	
Lower Buller River, Nelson ...	Tertiary gold-drift of diorite slate ...	54·0	...	42·3	59·0	Auriferous.
Upper Molyneux River, Otago ...	Mica-schist	82·7	...	9·7	65·9	Auriferous.
Lower Molyneux River, Otago ...	Mica-schist and Tertiary strata ...	74·4	...	2·5	58·7	Auriferous and with 12 per cent. of glauconite.
Mountain stream, Canterbury ...	Palæozoic slates...	62·7	37·2	...	66·2	
Mountain stream, Otago	Palæozoic slates...	86·1	10·5	...	58·5	Auriferous.
Tuapeka, Otago	Old gold drift	2·2	92·8	...	63·8	Auriferous.
Wakatipu, Otago	Mica-schist	80·0	7·6	...	52·9	Auriferous.
Mataura River (Upper)	Diorite slate	9·8	...	70·9	41·2	
Mataura River	Old gold drift	63·5	16·1	8·0	60·6	
Stewart Island	Granitic rocks with greenstone dykes	77·8	...	20·1	57·3	Auriferous.
Stewart Island	Hornblende rocks	71·5	20·0	8·2	70·1	Auriferous.
Anatoke, Nelson	Granite and hornblende	79·8	7·7	3·4	60·2	Auriferous.
Mahinapua Lake (old channel of Hokitika)	River drift from diorite rocks ...	...	...	58·0	29·1	Auriferous, with garnets, topaz, disthene, &c.
Sea-beach, Hokitika	Sea-sand drift	75·0			54·0	Auriferous.
Motueka River, Nelson	Tertiary strata and granite ...	33·0	32·5		42·0	Auriferous.
Wairau River, Marlborough ...	Tertiary strata and granite-schist ...	21·0	48·4		38·9	Auriferous.
Wanganui River, Nelson	Granite and Tertiary	54·0	13·0		43·2	Auriferous.
Saddle Hill, Otago	Basaltic	58·3	...	25·6	52·9	
Green Island, Otago	Basaltic or sea-beach	53·3	...	29·6	50·3	
Hooper Inlet	Basaltic or sea-beach	20·0	74·2		53·0	
West Bluff, Southland, Foveaux Strait	Diorite or sea-beach	12·2	...	40·6	28·6	Auriferous and platiniferous.
D'Urville Island, Nelson	Diabase and granite	78·6	...	...	57·4	Chrome iron.
Taranaki beach	Trachyte	91·9	...	6·2	70·1	
Taranaki beach	Trachyte	71·0	...	8·0	56·1	Olivine and hornblende.
Tauranga beach	Trachyte	87·4	8·6	...	68·0	

The composition of the chief massive ores of iron may be illustrated by the following analyses:—

MASSIVE IRON ORES, OXIDES, AND TITANITES.

Variety.	Locality.	Centesimal Composition.					Percentage of Iron.
		Magnetite.	Hæmatite.	Titanic Iron.	Siliceous Matters.	Water.	
Impure magnetite	Manukau, Auckland ...	60·20	37·90	traces	1·90	...	70·06
Magnetite ...	Dunstan Gorge, Otago	86·32	...	traces	13·68	...	63·60
Hæmatite ...	Dunstan, Otago ...	...	96·11	...	3·89	...	68·30
Magnetite ...	Dun Mountain, Nelson	...	90·62	...	7·60	1·80	63·40
Mixed magnetite and hæmatite	Maramarua, Auckland	2·24	87·10	traces	10·66	...	62·30
Bog iron ore ...	Spring Swamp, Auckland	...	73·17	...	13·83	13·00	51·22
Brown iron ore...	Raglan	...	72·69	...	9·68	17·60	50·88
Brown iron ore*	Kawau	...	67·98	...	19·65	12·37	47·58
Hydrous hæmatite†	Parapara, Nelson ...	...	62·68	...	24·08	13·24	43·87
Hydrous hæmatite	Mount Pee, Nelson ...	...	...	...	...	...	56·00

* Manganese oxide, 1·38. † Contains a little manganese.

Spathic Iron Ore.—This occurs in considerable quantity in the Collingwood District, in most cases more or less oxidized; one form of this ore known as black-band is one of the most valuable kinds known, and alternates with the coal-seams in Collingwood. A specimen of a siliceous and spathic iron ore from Otamataura Gully is constituted approximately as follows:—

Carbonate of iron	56·9
Carbonate of lime and magnesia ...	2·8
Siliceous matters	40·3
	100·0

The iron amounts to about 27 per cent.

Other large deposits of spathic iron ore have been found at Foote's Coal Mine at the Miranda Redoubt, and Jenkins's Coal Mine, Nelson. They contain 40 per cent. and 41 per cent. of iron respectively.

BLACK-BANDS, OR SPATHIC IRON ORES.

Variety.	Locality.	Protoxide of Iron.	Sesquioxide of Iron.	Carbonic Acid.	Silicates.	Percentage of Iron.
Black-band ...	Collingwood, Nelson ...	35·23	25·77	21·12	3·93	46·06
Black-band ...	Collingwood, Nelson ...	40·38	5·26	21·97	16·69	35·12
Spathic ...	Miranda, Auckland ...	...	...	...	...	40·08
Spathic ...	Jenkins's Mine, Nelson ...	...	...	...	...	41·00

ANALYSIS OF TWO SPECIMENS.

	Spathic Iron Ores.	
	Malvern Hills.	Collingwood
Protoxide of iron	51·2	35·23
Sesquioxide of iron	...	25·77
Oxide of magnesia	·8	1·00
Alumina...	1·8	2·11
Magnesia	·4	1·94
Lime	·3	·71
Silica	13·6	·90
Sulphuric acid	...	traces
Carbonic acid	31·2	21·12
Phosphoric acid		not determined
Sulphide of iron	...	·41
Water	·7	1·96
Organic matter	...	5·72
Silicates undecomposed by acids	...	3·03
	100·0	99·90

Hæmatite, containing about 40 per cent. of iron, occurs intermixed with quartz pebbles, in a stratum 100 feet thick exposed over several acres, at Parapara, Nelson, and from it an excellent paint is manufactured, which, being a pure peroxide of iron, is the best preservative for that metal. Wood coated with this paint is comparatively non-inflammable, and it is therefore much used in painting wooden buildings.

CHROME ORE.

This ore, which is a mixture of chromic iron and alumina, is chiefly associated with magnesian rock, resembling olivine in composition, named *Dunite* by Dr. Hochstetter. It occurs in veins often 12 feet in thickness, and sometimes contains as much as 80 per cent. of chrome ore. This ore has been largely exported from Nelson, and is used for the manufacture of salts of chromic acid, possessing the properties of brilliant dyes. The pure ore contains 50 per cent. of the chrome oxide, and is worth £11 to £20 per ton, according to the state of the market.

COPPER ORE.

Copper mines have been worked in Auckland on Great Barrier Island and Kawau Island, and to a small extent in Doubtless Bay. It has been found associated with the metamorphic rocks in Otago and at Waipori, where a 4-foot sulphide of copper (pyrites) lode exists. An attempt to trace this lode was made for a short time and then abandoned.

A carbonate of copper is found in the same locality, but only in rolled fragments.

Copper has also been found in the form of cuprite and copper-glance in the Dun Mountain, Nelson; and on D'Urville Island, at which latter place the ore has been traced to a depth of 100 feet, some of the better samples from this place yielding as much as 45 per cent. of copper.

A lode of copper-pyrites mixed with pyrrhotine has also been discovered in Dusky Sound, Otago, and an attempt has been made to open up a mine at that place.

An interesting occurrence of native copper disseminated as fine grains through a granular serpentinous rock should also be noted. The extent of the ore is as yet unknown, but it occurs in the serpentine mineral belt of Nelson.

Cupreous iron ore in serpentine has been found at Dun Mountain. It is interesting from its being slightly auriferous.

Copper-pyrites is present in a lode 3 to 5 feet thick in mica-schist, at Moke Creek, Wakatipu Lake: it is associated with carbonate and native copper. The ore contains the high proportion of 11 to 55 per cent. of metallic copper, the usual average of Cornish ore being only 5 per cent. There is limestone in close vicinity to the lode, so that there would be no difficulty in reducing the ore to a "regulus," in which state it would save cost in shipment.

Near Collingwood, Nelson, a lode has been opened up, and contains 22 to 25 per cent. of metallic copper.

Grey sulphide, found at Wangapeka, Nelson, contains 55 per cent. of copper, together with a little silver and gold.

In Kawau Island, Auckland, the lode first produced 16 per cent. of copper, and then fell off to 8 per cent, and at the bottom of the workings to about 5 per cent. The width of the lode was 8 feet. The workings were discontinued chiefly on account of the high price of coal consequent on gold discoveries.

In Great Barrier Island the ore (pyrites) occurs in a quartz matrix. A fair sample of the mixed specimen afforded 26·62 per cent. of copper. The Otea Copper-Mining Company worked this pyrites ore to a considerable extent.

Lead Ores.

Lead occurs as galena in the District of Nelson, at Rangitoto Mountain in Westland, and also at the Thames Gold Field. It invariably contains silver to a considerable amount. The following localities may be mentioned:—

Galena from Bedstead Gully, Collingwood.

Galena and zinc-blende from Parapara Valley.

Argentiferous lead ore from Richmond Hill, Parapara; value £50 per ton.

Galena, Wangapeka, Nelson. Sulphide of lead, with quartz that contains also sulphides of iron, and antimony with gold, in veins in felspathic schist. The galena contains 26 oz. of silver per ton, while the gold is only in those parts of the ore that contain iron-pyrites.

Galena with zinc-blende, Perseverance Mine, Collingwood, Nelson. Occurs in a band, 2 to 5 feet thick, parallel with auriferous quartz veins; the galena and blende are both pure, but so intermixed in the lode that they could not be reduced separately.

Zinc Ores.

Zinc ore occurs at the Perseverance Mine, Collingwood, Nelson, and in small quantity in Tararua Creek, Thames, where it is found in white cement with auriferous veins. It contains 60 per cent. of metallic zinc, which is worth about £15 per ton.

It is also found in the following localities:—

Zinc-blende and galena from Bedstead Gully, Collingwood.

Zinc as yellow or honey blende from Perseverance Mine, Collingwood, Nelson.

Zinc-blende with galena and pyrites, the former having about 4 oz. of silver and the latter about 5 oz. of gold per ton, Mount Rangitoto, Westland.

Antimony Ores.

Stibnite lodes were discovered in 1873 near the coast of Queen Charlotte Sound, Marlborough, and proved to contain from 51·12 to 69·40 per cent. of antimony, the matrix being quartz. Similar lodes have been known for many years in the Shotover district, at Hindon, at Waipori, in the Carrick Mountains, and other places in Otago.

A sulphide-of-antimony lode occurs some miles south of Collingwood, containing no less than ·757 per cent. of silver, which is equal to 185·88 troy ounces per ton.

Besides these localities antimony ores are found at the Thames and at Reefton, associated with gold; and also at Langdon's Reef, near Greymouth.

Manganese Ores.

These ores are useful for generation of chlorine for bleaching purposes, also for calico-printing, &c. The values of these common ores are from £3 to £4 per ton, and the following classes of them have been found:—

Rhodonite (silicate of manganese), at Dunstan, Otago, as rolled masses; percentage of manganese about 40.

Wad (hydrous oxide), at Port Hardy, D'Urville Island, Nelson; percentage of manganese about 45.

Braunite, or manganese oxide, on Malvern Hills, Canterbury.

Ores are also found at Whangarei in Auckland, at Ohariu near Wellington, and in Napier; the latter contains 44 per cent. of manganese oxide, the remainder being mostly clay.

The same ore, although of better quality, is at present being successfully worked in the Bay of Islands. The shipments for the year 1879 amounted to 2,140 tons, valued at £8,338. In 1881 the shipments were 1,271 tons, valued at £3,283.

Mineral Oils.

In 1866 attention was first directed to the occurrence in the colony of petroleum, and some very fine oils have since then been found. There are three principal localities, and these produce each a distinct kind of oil :—

1. The Sugarloaves, in the Taranaki Provincial District.

2. Poverty Bay, on the east coast of the Provincial District of Auckland.

3. Manutahi, Waiapu, East Cape.

The oil from the first has a very high specific gravity, ·960 to ·964 at 60° Fahr. (water at 1). It has thus too much carbon in its composition for its commercial success as an illuminating oil, but is capable of affording a valuable lubricating oil. It resembles oil occurring in Santa Barbara County, California.

The second kind, from Waiapu, Poverty Bay, is a true paraffin oil resembling the Canadian oil. By three successive distillations, and treatment with acids and alkalies, about 65 per cent. of a good illuminating oil is obtainable, with a specific gravity of ·843.

The third produces a pale-brown oil, nearly or quite transparent, specific gravity ·829 at 60° Fahr.; burns well in a kerosene lamp for some time, and is therefore of a very superior class; it contains only traces of paraffin, and produces 84 per cent. of an illuminating oil, fit for use in kerosene lamps, by means of a single distillation. By two more distillations 66 per cent. of the crude oil has a specific gravity of ·811, which is that of common kerosene.

At Sugarloaf Point, Taranaki, the petroleum (rock oil) oozes from cracks in trachyte-breccia. Wells have been bored to the depth of many hundred feet, but no steady supply of oil has been obtained.

The crude oil has a specific gravity of ·962 at 60° Fahr., and yields, by fractional distillation, oils having the following gravities :—

2·0	per cent. of	oil of specific gravity	·874
10·0	,,	,,	·893
8·0	,,	,,	·917
60·0	,,	,,	·941
80·0	total distilled off.		
6·1	solid bitumen.		
12·4	fixed carbon.		
1·5	ash.		
100·0			

The following is an analysis of the petroleum found at Waipaoa River, Poverty Bay, Auckland :—

2·00	per cent. of	oil, specific gravity	·809 (colourless).
16·00	,,	,,	·826 (nearly colourless).
16·00	,,	,,	·836 (pale yellow).
19·00	,,	,,	·850 (dark yellow).
11·00	,,	,,	·855 (brown, solid at 40° Fahr.)
8·00	,,	,,	·864
21·25	paraffin oil.		
93·25	total distilled off.		
6·75	residue in retort, pitch.		
100·00			

At Waiapu, East Coast, Auckland District, the crude oil has specific gravity of ·872 at 58° Fahr.; boiling point, 290° Fahr.; flashing point, 230° Fahr. A sample with a specific gravity of ·8294 gives—

40·00	per cent. of	oil, specific gravity	·800 (colourless).
33·00	,,	,,	·826 (pale-coloured oil).
12·50	,,	,,	·840
6·25	,,	,,	·860
4·25	,,	,,	·870
96·00	total distilled off.		
4·00	residue in retort.		
100·00			

Another analysis yielded—

11·20	per cent.,	specific gravity ·820	(fine lamp-oil).
37·75	„	„ ·853	(inferior lamp-oil).
26·69	„	„	(lubricating oil).
16·00	„	„	(paraffin).
91·64	total distilled off.		
8·36	bituminous residue.		
100·00			

Oil Shales.

Petroleum Oil Shales.—Pyroschist, or bituminous shale, occurs to a small extent in the upper portion of the coal formation. Specimens have been examined from D'Urville Island, in Cook Strait; Mongonui and Waiapu, in Auckland; Kaikorai and Blueskin, in Otago.

A good variety of oil-producing shale is obtained from the Chatham Islands, but it contains traces of sulphuretted hydrogen.

These shales have been distilled for oil, those from Mongonui and the Chatham Islands producing the following excellent results:—

Locality.	Centesimal Composition.					Relative Percentage of Volatile Matter.	Relative Percentage of Fixed Carbon.
	Volatile Matters.	Carbon.	Water.	Ash.	Sulphur.		
D'Urville Island ...	81·79	7·98	·69	9·54	traces	91·11	8·89
Mongonui	75·20	9·30	1·80	13·70	traces	88·99	11·01
Chatham Island ...	66·43	20·41	4·61	8·55	traces	76·49	23·51
Chatham Island ...	64·67	19·87	7·13	8·33	traces	76·49	23·51

Graphite.

The mineralized substance known as graphite—plumbago—black lead—consists of carbon in mechanical admixture with siliceous matter, as clay, sand, or limestone, and in varying proportions, and is the ultimate product of vegetable remains, mineralized to the highest degree.

It has been found at Pakawau; in the vicinity of Wellington; and in the pure state embedded in marbles from the West Coast.

The pure amorphous variety is used for the manufacture of pencils, and for lubricants for machinery, while the impure siliceous or argillaceous graphites find extensive employment in the manufacture of crucibles, and for polishing material for ironwork.

Graphite of the first quality has not been found yet in any quantity in New Zealand, but there is an abundance of the less pure

varieties. It has been found in greater quantity in the District of Nelson than elsewhere, but still many other localities yield this mineral in various states of purity, as at Malvern Hills, Canterbury, and Dunstan, Otago, where it is of fair average quality.

A valuable sample of graphite has lately been reported from Waiokura Creek, Waimate, although the mineral has not yet been found *in situ*. The following are analyses of two samples:—

	a.	*b.*
Fixed carbon	86·9 ...	92·5
Volatile matter	6·6 ...	4·5
Ash	6·5 ...	3·0
	100·0	100·0

This specimen is of a very homogeneous character, and if, as is probable, large bands should be found, the discovery may prove of great value. The colour of the ash is reddish-white.

Building Stones, etc.

Abundant supplies of excellent stones for roads and building purposes are found in every part of New Zealand. The varieties useful as such may be divided into—

1. Basalts and diorites;
2. Trachytes, granites, and crystalline schists;
3. Limestones (freestones in part);
4. Sandstones (freestones).

Basalts, locally called "bluestones," occur of a quality useful for road-metal, house-blocks, and ordinary rubble masonry. They are found partly underlying and partly overlying the Tertiary rocks, interstratified with tufaceous clays and local beds of altered volcanic ash. In the North Island these volcanic rocks are largely developed, and include some of very recent date.

True lavas and scorias are of frequent occurrence in the northern part of the Island. The latter have been quarried by the prisoners at Mount Eden, Auckland; their colour is dark-grey, and though absorbent they are very hard and coherent.

In the South Island, on the other hand, the igneous rocks appear to be of much earlier date, and to have been nearly all of submarine origin. They are principally confined to the eastern seaboard, only rarely occurring at a greater distance than forty miles from the coast.

The Halswell quarries, Canterbury, produce an exceedingly hard and close-grained stone of a dull leaden-grey colour; but its excessive hardness will necessarily limit its usefulness.

Diorite.—This stone occurs on the west coast of Otago, at the Great Barrier Island, and in many other localities where it can be quarried.

Aphanite Breccia forms a solid building stone that has been used at Dog Island and elsewhere.

Porphyrites.—These stones are found at Flagstaff Hill, Water of Leith, and in the Malvern Hills.

Syenites occur at Dog Island and the Bluff, and at various localities on the West Coast and in Stewart Island; but the chief supply now available for industrial purposes is at the Bluff, and the Boulder Bank at Nelson where a beautiful green variety occurs. It is hard, compact, and of a uniformly bluish-grey tint of great beauty; consequently it is suitable for kerbing, paving, and massive masonry, as well as for monumental and architectural work.

Trachytes.—The group of trachytes contains many varieties, both of composition and texture, but they all, together with the granites, are distinguished from the first group by containing a large proportion of silica.

At Port Chalmers a fine grey stone occurs. Another kind, a good freestone, is obtained at Harbour Cove, Otago, and Creightonville, Canterbury.

Granular trachytes are obtained from Governor's Bay, Lyttelton.

Trachyte porphyry is found at Taiaroa Head, Moeraki, and Portobello; and from Port Chalmers a breccia is obtained, with which the graving dock there is entirely built. All the kerbing in Dunedin is from the quarries of this stone.

Sanadine trachyte is found at Portobello, Otago Harbour.

Phonolite or clinkstone of a columnar character occurs at Bell Hill, Dunedin, and a laminated and spheroidal variety at Blanket Bay.

The gaol and some other old buildings of Dunedin are built of a spheroidal clinkstone, which is of a mottled grey colour, and exceedingly hard and compact. The foundations of buildings in that city are frequently constructed with the same stone, which is eminently suited for the purpose. This stone is probably metamorphosed tufaceous sandstone.

Granite.—Granite is only found as mountain masses at Preservation and Chalky Inlets, on the western coast of the South Island, but exists in large veins and blocks in Stewart Island, and along the whole of the West Coast.

At the first-named localities the granite is of a pinkish tinge with grey spots, and rather coarse in the grain.

The veins and blocks supply a fine-grained, beautifully-coloured

stone, more suitable for architectural and monumental work than the former.

At Seal Island a fine grey granite vein occurs, having a smooth grain.

Granite rocks occur in detached areas in the Westland District, but not in accessible situations, being very different in that respect from those occurring on the south-west coast, where they admit of being quarried and shipped with great facility. At Astrolabe Island, and Tonga Harbour on the west shore of Blind Bay, is probably the easiest place from which granite could be quarried. It is there of fine quality, and can be quarried out in masses suitable for kerbing and harbour works.

A variety with garnets is found at Metal Mountain, Milford Sound.

Crystalline Schists.—Gneiss of equally good quality with the granite from the south-west coast is to be found in many other inlets, and on the north shore of Milford Sound there is one point where there is an immense accumulation of blocks of a grey variety mottled with crystals of garnet, and of all sizes and shapes, lying as if ready for shipment. Other localities are "Connecting Arm" and Anchor Harbour.

Marble.—The purest form of this series is found in many localities in the South Island; statuary marble occurs among the gneiss and hornblende schists of the West Coast. The grain of most samples hitherto found is rather coarse, but closer-grained kinds exist in Caswell Sound, where a quarry has been opened, and also in the Mount Arthur district of Nelson.

Granular or crystalline and subcrystalline limestones of every shade and colour, texture and hardness, occur plentifully, chiefly in the South Island.

Extensive masses of the harder compact kinds occur in the Upper Palæozoic formations. They are generally speaking of a blue colour and unfossiliferous.

One mass or stratum occurs in the slates of the Kakanui Range; it is several hundred feet thick, with an outcrop of five miles in length, and is probably the best in the District of Otago.

A great variety of excellent limestones suitable for building stones might be obtained from the Horse Range (Shag Valley side); at Twelve-Mile Creek, on Lake Wakatipu; Malvern Hills, Canterbury; and Hokanui Hills, Southland. In the latter district a very fine kind is obtainable, very slightly coloured; it belongs to the Cretaceo-tertiary series.

A white granular limestone called the Oamaru stone is worked in extensive quarries in the Oamaru district; but it occupies a large tract of the country in the north part of Otago and throughout Canterbury,

and has a remarkable uniformity of colour and texture; its weight, wet from the quarry, is 105 lb. per cubic foot, and when perfectly dry 92 lb. A considerable quantity has been exported to Melbourne.

The principal buildings of Dunedin are built of this stone, which shows a very fair amount of durability.

At Wairoa, Auckland, there is a good hard close-grained stone, of a light, buff colour, mottled with black grains.

Earthy Limestone.

Freestone.—A fine limestone of a brown tint occurs near Dunedin, at Boat Harbour; it works freely, seems durable, and is said to exist in large quantities, and to be procurable in moderately-sized blocks; it has the disadvantage of not being in an easily accessible situation.

A hard, shelly, and white limestone, belonging to a younger formation than the Oamaru stone, occurs at Kakanui, and is used in some structures in that locality; it is of a uniform colour and consistency, is easily worked, and procurable in large blocks. The supply is unlimited.

Southland possesses a fair stone of this kind.

A valuable limestone occurs on the Otago Peninsula, near Port Chalmers, in two beds, one dark-coloured and the other yellow: the last contains a rather large amount of fine-grained sand, yellow and black. They burn to pretty good quicklime.

A good stone for lime occurs on Scinde Island, Napier; it is fossiliferous, and of Upper Tertiary age.

At Oamaru a compact variety of limestone is largely burnt for lime, but it is found in dislocated and concretionary masses intermixed with quantities of worthless rock, which gradually increases the expense of extraction. It is fossiliferous.

A hard very compact grey-coloured stone of considerable purity occurs near the Moke Creek copper lodes, and would afford the flux required for reducing the ore. It is fossiliferous, and of Lower Tertiary date.

Varieties.

Travertine Limestone is found at Dunstan Gorge, Otago; it makes very white lime. It has the usual porosity of this kind of stone.

Geodic Limestone.—This occurs at Hampden, Otago, and has numerous sparry cavities lined with crystallized calc-spar.

Cellular Limestone occurs at Nelson. This kind has numerous angular cells or holes.

A limestone breccia occurs at Ruataniwha.

Lithographic Limestone.—A lithographic limestone is found at Oamaru; it is a very fine-grained stone, hard and compact; its frac-

ture is conchoidal. It occurs in concretions in the limestone, and not in slabs. The quarry is situated where the Lower Tertiary strata have undergone alterations by the extrusion of submarine igneous rocks, probably during their deposition. An extensive deposit of lithographic limestone also occurs at Abbey Rocks, near Paringa River, Westland, from which locality large slabs could be obtained. Lithographic limestone is also found in the Chatham Islands.

Chalk with black and white flints is found at Kaikoura Peninsula and in the northern part of Canterbury; a very pure bed of this material, which is of value for the manufacture of cement, occurring near Oxford.

Sandstones are very plentiful throughout the Islands, and are very varied in hue. The different kinds may be classed under the following heads:—

a. Siliceous sandstones, in which the cementing paste is a siliceous infiltration.

b. Calcareous sandstone, having carbonate of lime for its cohesive power.

c. Argillaceous sandstones, or claystones, in which clay replaces either of the above substances.

a. The true *Siliceous Sandstones* are found at the base of the Tertiary and in the Upper Secondary formations, where they are associated with beds of coal.

b. *Calcareous Sandstones*.—These are confined to the Upper Tertiary rocks, and are variable and concretionary.

c. *Argillaceous Sandstones or Mudstones—Claystones*.—These, like the last kind, are found only in the Upper Tertiary beds, and are variable.

Cement.

Natural-cement stones, or septaria, occur in the lower part of the marine Tertiary series, and in some cases are quite equal in quality to those which are burnt for the manufacture of hydraulic cement in Europe. The cement hitherto used so largely in New Zealand has been imported, but, with the great resources the colony possesses in the raw material for the manufacture, this will probably not be long continued.

In the following Table, Nos. 1 and 3 are analyses of the whole nodule, while Nos. 2 and 4 are without the calcareous veins. Those from Moeraki are very hard and compact; colour mottled grey; specific gravity 2·655; hygroscopic water 60 per cent. at time of analysis. Those from Amuri are similar in character. Analyses of septaria used

in England and France for manufacture in Roman cement are added for the sake of comparison :—

Constituents.	New Zealand.				England.	France.
	Moeraki.		Amuri.		Sheppey.	Boulogne.
	(1.)	(2.)	(3.)	(4.)		
Carbonate of lime ...	72·4	50·8	68·6	54·9	69·0	63·9
Carbonate of magnesia ..	·3	...	1·7	1·5	...	...
Alumina and iron oxides	8·7	7·6	6·5	6·4	10·5	12·3
Soluble silica	·8	...	1·0	1·0	18·0	15·0
Sand and clay	17·8	41·6	31·2	31·9		
Water	·6	...	1·1	1·2	1·3	·6

Materials for Portland Cement.

The manufacture of Portland cement might be made an important industry in New Zealand, excellent chalk and lime and non-ferruginous clay being obtainable.

The Italian pozzuolana might be imitated also, as there are extensive deposits of volcanic tufas occurring in the North and South Islands. Those volcanic sands would require then to be ground up with an admixture of lime, making, when correctly proportioned, an excellent hydraulic mortar. In Auckland an artificial cement is largely in use, prepared from hydraulic lime from the Tertiary strata at Mahurangi, which, when properly mixed with scoria dust, forms a most valuable cement for concrete buildings, and also for submarine walls and docks.

Bricks.

The materials for brick-making are plentiful throughout the country. The clays are admirably adapted for the manufacture of the best kinds, and when properly weathered and tempered by mixing the clay into a perfectly homogeneous mass, and thoroughly burnt, the bricks are equal to any of British manufacture.

Pottery.

The success of the pottery works that have been established at Tokomairiro, also at Christchurch and other places, has proved the adaptability of the fireclays and pottery clays of the colony for the best kinds of fire-bricks, drain-pipes, chimney-pots, tiles, and all kinds of pottery, porcelain, and terra-cotta goods.

CLIMATE.

Meteorological Observations.

Meteorological observations have been made ever since the founding of the colony, though at first they were of an irregular character, and only with the view of comparing the climate of New Zealand with that of other countries. From 1853 meteorological reports appear regularly appended to the Registrar-General's statistics; but it was not until 1859 that systematic observations were undertaken by a department established by Government. In that year eleven stations, equipped with carefully-compared instruments, were established at Mongonui, Auckland, Napier, New Plymouth, and Wellington, in the North Island; Nelson, Christchurch, Dunedin, and Invercargill, and some years later at Hokitika and Bealey, in the South Island.

At a later date several new stations were established, making in all fifteen stations, from which monthly returns were sent to the head office in Wellington. Since then the number of chief stations has been reduced to three, and the number of secondary stations has been increased. From these the following returns are prepared for publication:—

I. A provisional return obtained by telegraph of the results at the chief towns, which is appended to the monthly report of vital statistics.

II. An abstract of the results for each month, compared with the averages for the same month in previous years, is published in the *Gazette* and circulated in a separate form to all correspondents. These abstracts are intended for the guidance of agriculturalists and other persons who require to watch the peculiarities of each season closely.

III. Tabular abstracts, in the same form that has been followed since 1853, are prepared for the annual volume of statistics.

IV. A biennial report on the climate, embodying all the most interesting results, is published in octavo pamphlet form and largely circulated.

In addition to the above, daily telegraphic reports of the weather are obtained at 9 a.m. from twenty-five stations, and are exhibited for public information at all the shipping ports in the colony. Since 1874 this branch has been placed under the charge of a special signal officer, who issues warnings of the probable approach of storms to the different seaports.

An intercolonial weather exchange has also been organized, and

reports are received from different parts of Australia every day, and published in the form of a diagram in the leading newspapers throughout the colony.

The following tables embody the averages which have been ascertained for the different elements of the climate of New Zealand.

Temperature.

The climate resembles that of Great Britain, but is more equable, the extremes of daily temperature only varying throughout the year by an average of 20°, whilst London is 7° colder than the North and 4° colder than the South Island of New Zealand. The mean annual temperature of the North Island is 57°, and of the South Island 52°, that of London and New York being 51°.

The mean annual temperature of the different seasons for the whole colony is, in spring 55°, in summer 63°, in autumn 57°, and in winter 48°.

Comparative Temperatures of New Zealand.

I. General Abstract.

Stations.	S. Lat.	Long. E. from Greenwich.	Number of Years of Observation.	Year.	Winter.	Spring.	Summer.	Autumn.	Difference of the Coldest and Warmest Months.	Yearly Means. Max.	Yearly Means. Min.	Yearly Fluctuation.
North Island.	° ′	° ′										
Mongonui ...	35 1	173 28	10	59·90	53·06	58·28	66·56	61·52	15·12	89·10	31·82	57·28
Auckland ...	36 50	174 51	20	59·54	52·34	57·56	66·92	61·16	16·02	88·52	33·26	55·26
Taranaki ...	39 4	174 5	14	57·56	50·90	55·94	64·58	58·82	15·66	86·90	30·02	56·88
Napier ...	39 29	176 55	10	57·56	49·10	57·74	66·20	57·02	19·26	90·00	32·10	59·90
Wellington ...	41 16	174 47	14	55·58	48·74	54·50	62·24	56·66	14·76	78·44	32·18	46·26
Wanganui ...	39 56	175 6	3	55·90	48·71	53·31	63·31	57·12	16·70	86·00	29·00	55·00
South Island.												
Nelson ...	41 16	173 19	11	54·86	46·58	54·50	62·78	55·76	17·10	82 04	27·32	54·72
Hokitika ...	42 42	170 59	10	52·34	45·50	51·62	59·18	53·06	14·76	74·12	28·22	45·90
Bealey* ...	43 2	171 31	9	46·76	37·40	46·04	54·86	48·56	18·18	78·08	12·38	65·70
Christchurch ...	42 33	172 39	12	52·88	43·52	53·24	61·52	53·60	18·72	88 16	25·16	63·00
Dunedin† ...	45 52	170 31	17	50·72	43·52	50·54	57 20	51·80	15·30	84·74	29·84	54·90
nvercargill ...	46 17	168 20	14	50·36	42·26	51·26	58·10	50·00	16·92	83·84	20·12	63·72
Queenstown† ...	45 2	165 39	3	51·01	40·01	50·92	64·02	52·31	21·25	84·60	23·21	61·39

* Height above sea, 2,104 feet. † Height above sea, 550 feet. ‡ Height above sea, 1,070 feet.

II. Daily Range of Temperature.

Difference of the Mean Daily Extremes.

Stations.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Year.
North Island.													
Mongonui ...	15·48	16·74	15 30	19·08	18·18	16·92	15·30	15·66	16·92	16·02	14·58	16·74	16·38
Auckland ...	18·90	19·80	20·88	19·80	19·08	16·92	15·30	15·48	16·74	15·84	16·56	18·00	17·82
Taranaki ...	19·62	21·60	20·16	21·42	19·44	15·84	15·30	14·40	16·56	18·00	16·74	18·54	18·18
Napier ...	18·72	21·60	21·78	17·82	15·12	14·94	13·86	15·30	15·12	18·00	18·18	19·08	17·46
Welling'on ...	13·32	13·50	12·42	12·42	11·70	11·16	10·62	10·62	11·52	11·88	12·24	13·50	12·06
South Island.													
Nelson ...	20·34	23·40	20·70	21·24	17·10	17·82	19·08	19·08	19·62	21·06	21·42	22·14	20·16
Hokitika ...	11·34	11·16	13·32	12·60	12·78	13·86	14·58	13·68	14·76	15·66	12·24	11·52	13·14
Christchurch ...	17·10	18·36	16·56	17·46	17·10	16·38	14·94	16·56	16·02	16·20	18·54	19·08	17·10
Dunedin ...	16·20	15·66	15·66	15·12	13·68	11·52	10·44	10·62	12·06	13·32	13·68	15·30	13·68
Invercargill ...	22·50	21·78	22·50	22·68	18·00	16·02	17·64	16·92	19·44	22·32	21·06	21·06	20·16

Comparison between Climate on East and West Coasts.

The climate on the west coast of both Islands is more equable than on the east, the difference between the average summer and winter temperature being nearly four degrees greater on the south-east portion of the North Island, and seven degrees on that of the South Island, than on the north-west, on which the equatorial winds impinge. This constant wind is the most important feature in the meteorology of New Zealand, and is rendered more striking by comparing the annual fluctuation of temperature on the opposite seaboards of the South Island, which have a greater range of temperature by eighteen degrees at Christchurch on the east than at Hokitika on the west.

Rainfall.

I. Review of the Proportions of Rain in New Zealand.

Stations.	Rainfall.					Probability of Rain.					Mean Max. in 24 Hours.
	Winter.	Spring.	Summer.	Autumn.	Total for Year.	Winter.	Spring.	Summer.	Autumn.	Year.	
N. Island.	Percentage.				Inches.						
Mongonui ...	36	24	23	17	58·132	0·66	0·50	0·33	0·39	0·47	3·500
Auckland ...	32	25	19	24	47·008	0·61	0·52	0·33	0·41	0·47	3·358
Taranaki ...	29	27	20	23	59·442	0·52	0·51	0·35	0·38	0·44	2·520
Napier ...	39	15	35	11	36·004	0·26	0·22	0·24	0·17	0·22	...
Wellington	29	24	24	22	51·542	0·51	0·43	0·37	0·40	0·43	2·610
S. Island.											
Nelson ...	27	26	29	17	61·599	0·27	0·25	0·22	0·18	0·23	7·189
Hokitika ...	24	28	28	20	111·653	0·52	0·61	0·57	0·48	0·54	3·532
Bealey ...	22	28	31	18	105·340	0·53	0·61	0·56	0·47	0·54	3·512
Christchurch	31	21	25	23	25·536	0·36	0·33	0·28	0·24	0·30	1·622
Dunedin ...	23	23	28	26	31·682	0·51	0·55	0·58	0·54	0·54	2·079
Southland ...	26	23	26	26	49·732	0·47	0·47	0·40	0·49	0·46	1·130

II. Totals of Monthly Rainfall in Inches.

Stations.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
N. Island.												
Mongonui ...	2·339	3·209	7·787	1·492	2·882	5·461	8·319	6·598	6·241	5·831	3·701	4·272
Auckland ...	3·409	2·071	3·272	3·150	3·402	4·771	5·721	5·279	4·331	4·331	3·520	3·752
Taranaki ...	4·921	3·221	3·908	2·579	3·520	7·720	5·914	6·299	5·177	5·252	5·969	4·858
Napier ...	5·630	3·571	3·650	1·130	1·358	1·532	3·402	3·681	6·870	2·414	1·539	1·201
Wellington	3·999	3·882	4·453	3·780	3·280	4·540	5·212	5·658	4·299	3·941	5·000	3 500
S. Island.												
Nelson ...	4·319	5·358	8·331	2·063	3·221	5·177	4 441	6·319	6·233	6·319	5·000	4·815
Hokitika ...	12·169	8·902	9·871	6·752	8·611	6·370	8·240	9·638	9·130	5·878	13·402	12·690
Bealey ...	14·087	9·681	8·902	3·921	7·433	8·079	5·019	10·378	7·799	5·811	15·501	8·733
Christchurch	1·622	2·311	2·370	1·752	1·811	2·280	3·189	2·449	2·319	1·161	2·142	2·130
Dunedin ...	3·012	3·599	2·142	2·220	2·122	3·949	2·441	2·500	2·228	2·000	2·500	2·969
Southland ...	3·622	5·279	3·921	3·980	3·571	5·401	5·019	3·441	4·390	2·661	3·929	4·520

The fluctuation in the annual rainfall at the principal stations is shown in the following table :—

RAINFALL.—1866 to 1881.

Stations.	Means for each Year, and Difference from General Average.							
	1866.	1867.	1868.	1869.	1870.	1871.	1872.	1873.
North Island.								
Auckland ...	42·000	53·180	49·087	52·797	44·831	47·505	42·096	41·237
	−3·306	+7·874	+3·781	+7·491	−·475	+2·199	−3·210	−4·069
Taranaki ...	55 700	60·690	50·420	55·125	54·720	72·120	63·640	53·120
	−2·384	+2·606	−7·664	−2·959	−3·364	+14·036	+5·656	−4·964
Napier ...	30·000	...	...	...	32·850	35·890	23·940	42·380
	−7·260	...	...	...	−4·410	−1·370	−13·320	−5·120
Wellington ...	41·100	41·950	55·522	56·768	48·205	64 057	50·945	54·985
	−9·681	−8·831	+4·741	+5·987	−2·576	+13·276	+·164	+4·204
South Island.								
Hokitika ...	127·500	110·510	120·210	88·210	116·680	122·440	123·210	96·170
	+15·344	−1·646	+8·054	−23·946	+4·524	+10·284	+11·054	−5·986
Christchurch ...	19·400	30·070	30·041	27·292	28·364	27·935	19·741	26·330
	−6·374	+4·296	+4·267	+1·518	+2·590	+2·161	−6·033	+·556
Dunedin ...	29·000	39·050	33·893	32·918	39·202	22·146	27·393	35·825
	−3·019	+7·031	+1·874	+·899	+7·283	−9·873	−4·626	+3·806
Southland ...	47·200	41·620	46·346	42·680	53·950	39·030	40·110	37·480
	+3·526	−2·054	+2·672	−·994	+10·276	−4·644	−3·564	−6·194

	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
North Island.								
Auckland ...	35·024	51·310	44·025	40·375	37·160	46·130	38·890	34·237
	−10·282	+6·004	−1·281	4·931	−8·146	+·824	−6·416	−11·069
Taranaki ...	57·220	66·960	48·180	52·000	56·730	60·180	47·220	...
	−·864	+8·876	−9·924	−6·084	−1·354	−2·096	−10·864	...
Napier ...	37·940	38·260	38·390	33·450	21·100	53·140	38·400	...
	+·680	+1·000	+1·130	−3·810	−16·160	+15·880	+·140	...
Wellington	53·496	65·827	43·374	51·925	54·602	57·441	46·767	50·132
	+2·715	+16·046	−7·401	+1·144	+3·821	+6·660	−4·014	−·649
South Island.								
Hokitika ...	104·480	130·790	116·325	136·660	154·446	128·295	122·840	...
	−7·676	+18·634	+4·169	+24·504	+42·290	+16·139	+10·684	...
Christchurch	22·790	32·310	23·990	23·720	13·540	23·180	17·670	*28·071
	−2·984	+6·536	−1·029	−2·054	−12·234	−2·594	−8·104	+2·297
Dunedin ...	28·739	42·631	38·260	37·460	45·235	42·099	33·063	26·402
	−3·280	+10·612	+5·586	+5·441	+13 216	+10·080	+1·044	−5·617
Southland ...	44·650	44·180	...	43·150	54·020	33·260	39·140	...
	+·976	+·506	...	−·524	+10·346	−10·414	−4·534	...

MEAN ANNUAL RAINFALL.

North Island.			*South Island.*		
Auckland ...	...	45·306	Hokitika ...	...	112·156
Taranaki ...	...	58·084	Christchurch...	...	25·774
Napier ...	...	37·260	Dunedin ...	...	32·019
Wellington ...	...	50·781	Southland ...	...	43·674

The observations that have been taken show that the northern part of New Zealand is within the influence of the subtropical winter

* Station moved from Christchurch to Lincoln, Canterbury.

rainfall, the probability of rainfall in winter in that part of the colony being twice as large as in summer.

In the south, however, the rainfall, though irregular, is distributed more equally over the year. The chief difference to be observed is that on the west coast spring rains prevail, and summer rains on the east coast; while in the middle of the colony the driest season is autumn, and in the south it is the winter and spring.

The contrast between the rainfalls on the east and west coasts, as with the temperature, is most striking. Thus, in the North Island, Napier on the east has only half the amount of rain that falls in Taranaki on the west. But the South Island, with its longitudinal range of lofty mountains, exhibits this feature in a still more marked manner, for the rainfall on the west is nearly five times greater than that on the east. The excess of precipitation on the coast is clearly illustrated by the distribution of the glaciers on the opposite sides of the range. Those on the west slope have an excessive supply of snow, and descend to a line where the mean annual temperature is 50° Fahr., while on the east slope they descend only to the mean annual temperature of 37°. The winter snow-line on the Southern Alps on the east side is 3,000 feet, and that on the west side is 3,700 feet.

The distribution of the rainfall in different parts of the Islands is best expressed by an approximate statement of the hydraulic discharge from the various drainage-areas. The average rainfall, and the percentage allowed for evaporation and soil-absorption, have been estimated for each area from such information as is available, but must only be accepted as provisional.

SCHEDULE of the PRINCIPAL RIVERS in NEW ZEALAND, showing approximately the AREAS of WATERSHEDS, the AVERAGE ANNUAL RAINFALL, and DISCHARGE for each.

Rivers.	Area.	Average Rainfall.	Estimated Discharge per Minute.	Remarks.
North Island.	Sq. Miles.	Inches.	Cubic Feet.	
Waikato	4,768	40	839,168	
Kaipara	2,622	47	545,376	
Wanganui	2,525	47	525,200	
Manawatu*	2,239	65	642,593	
Thames	1,779	48	377,148	Including Piako.
Rangitaiki	1,633	30	215,556	Have a common embouchure in a coastal lagoon.
Whakatane	1,014	35	156,156	
Rangitikei	1,435	50	315,700	
Wairoa*	1,303	45	257,994	
Mohaka	1,034	45	204,732	
Ngaruroro*	843	40	148,368	Might be concentrated on Napier Harbour.
Tutaekuri and Esk	487	35	73,998	

NOTE.—Rivers marked * have mountain sources not trapped by lakes, and are therefore subject to exceptional floods.

SCHEDULE of the PRINCIPAL RIVERS, &c.—*continued.*

Rivers.	Area.	Average Rainfall.	Estimated Discharge per Minute.	Remarks.
North Island—continued.	Sq. Miles.	Inches.	Cubic Feet.	
Tukituki	815	35	125,510	
Mokau	815	60	215,445	
Patea	622	55	151,146	
Waipaoa, Poverty Bay* ...	602	30	80,066	Partly combine in floods.
Gisborne	75	35	11,550	
Hokianga	560	50	123,760	
Waiapu*	505	40	88,880	
Waitara	501	56	123,747	
South Island.				
Clutha*	8,248	30	1,088,736	
Waitaki*	4,730	26	539,220	
Waiau (South)	3,079	41	557,299	
Mataura*	2,378	30	316,274	
Buller*	2,341	95	990,879	
Taieri*	2,317	37	379,988	
Grey*	1,572	90	624,084	
Wairau*	1,562	35	240,548	
Oreti	1,422	40	250,272	
Waimakariri*	1,922	55	345,546	
Rakaia*	1,401	50	308,220	
Rangitata*	752	48	159,424	
Selwyn (Lake Ellesmere) ...	718	30	94,776	
Jacob's	633	40	111,408	
Haast*	412	125	227,424	
Kaduka (Martin's Bay) ...	283	127	158,480	
Hokitika*	382	120	202,460	
Oamaru Creek	23	22	2,231	
Milford Lagoon and Opihi ...	888	28	109,224	

NOTE.—Rivers marked * have mountain sources not trapped by lakes, and are therefore subject to exceptional floods.

Periods of lasting drought are almost unknown in New Zealand, and only in two instances do the records show a whole month at any station without rain. The greatest day's rain recorded is 6½ inches at Auckland, and 9½ inches in Nelson. Similar heavy showers occur at the north-west stations, where the general average shows 70 inches in eighty-five days in the year. The opposite extreme is on the south-east, where 34 inches fell in 180 days.

PRESSURE OF AIR.

The mean atmospheric pressure in New Zealand between lat. 37° and 46° S. decreases from 29·981 to 29·804 inches; the average pressure being for all stations 29·919. For the corresponding north latitudes the average pressure is 30·005, but in the New Zealand area the fluctuations are much greater, and, though frequent, are tolerably regular in their periods. The maximum pressure occurs in April, and the minimum in November. The extreme range of the barometer is a little over two inches, and the average daily range from hourly observations is ·043 inch.

The following are the observed averages of pressure for a few of the principal stations :—

I. Monthly Range of Air Pressure.

Stations.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Year.
Auckland ...	0·657	0·681	0·728	0·756	0·909	0·961	1·043	1·051	0·965	0·886	0·827	0·835	1·417
Taranaki ...	0·740	0·883	0·886	0·934	1·028	0·917	1·094	1·138	1·024	1·051	0·929	0·752	1·594
Southland ...	1·193	1·122	0·854	1·039	1·079	1·240	1·256	1·248	1·197	1·094	1·240	1·169	1·732

II. Daily Amplitude.

Dec.	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.
0·038	0·034	0·038	0·044	0·050	0·046	0·041	0·048	0·044	0·050	0·042	0·042

III.—Hourly Fluctuation of Atmospheric Pressure and Elastic Force of Vapour.

A.M.

—	Mid-night.	1	2	3	4	5	6	7	8	9	10	11
Bar. ...	+·013	−·001	−·003	−·012	−·010	+·004	−·006	−·006	−·005	−·003	−·001	−·011
El. force	−·021	−·017	−·011	−·017	−·011	−·014	−·006	−·003	+·010	+·008	+·011	+·018

P.M.

—	Noon.	1	2	3	4	5	6	7	8	9	10	11
Bar. ...	−·012	−·012	−·016	−·010	−·008	−·003	+00·7	+·019	+·025	+·021	+·020	+·019
El. force	+·020	+·025	+·021	+·013	+·008	+·009	+00·3	−·002	−·006	−·006	−·007	−·011

Winds.

Owing to the fact that most atmospheric disturbances pass from west to east, with the centres of the depression to the south of New Zealand, there is a marked prevalence of westerly winds throughout all seasons, but they are much modified by the form of the land. When the centres pass to the north of New Zealand the result is that north-east winds impinge on the east coast, bringing rain, followed by cold south-easters, with heavy storms of rain and snow during winter in the south.

The more common westerly winds begin in the north-north-west, with heavy rain on the west coast, and gradually veer to south-west, when fair bright weather sets in on that coast; but the same southerly wind, sweeping along the east side of the Islands, brings heavy strong weather locally known as "southerly bursters," which, from the shape of the coast, reach the region of Cook Strait as south-east storms. All the other winds are either land or sea draughts, with fine light weather; or are moderate winds produced by

the circulation of the atmosphere round anticyclonic areas of high barometric pressure, that are far more persistent in their influence than the fast-moving cyclonic or low-pressure areas.

Thunderstorms.

Thunderstorms are most frequent in the districts where the changes of wind are most suddenly felt, from the moist equatorial currents to the cold polar currents of the south-west.

They are most frequent in spring on the west coast, except in the extreme south-west of Otago, where during winter thunderstorms are of almost daily occurrence.

There being no westerly station on that part of the coast, this does not appear in the following abstract:—

Average Frequency of Thunderstorms.

—	Mongonui.	Auckland.	Taranaki.	Hokitika.	Bealey.	Christchurch.	Dunedin.	Southland.
Winter	4·0	1·0	2·0	3·0	2·3	0·6	0·8	6·0
Spring	7·7	3·0	7·2	5·5	7·0	0·4	3·2	6·0
Summer	6·0	10·0	5·5	4·0	6·2	1·0	2·7	11·0
Autumn	0·5	4·0	2·0	2·0	1·8	1·0	0·5	6·5
Year	18·2	18·0	16·7	14·5	17·3	3·0	7·2	29·5

Black-bulb and Radiation Thermometers.

The difference in the amount of cloud in the atmosphere is best illustrated by a reference to the average readings of black-bulb and radiation thermometers, for which comparison certain observations from the stations on the opposite sea-coasts of the Southern Alps have been tabulated; but the extreme readings of the black-bulb thermometer, especially at the southern stations, are very remarkable, as they frequently reach to 175° Fahr.

—	Christchurch, East Coast, 42° 38′ S.L.			Hokitika, West Coast, 42° 42′ S.L.		
	Insolation.	Radiation.	Difference.	Insolation.	Radiation.	Difference.
Summer	131·72	44·78	86·94	84·02	48·38	35·64
Autumn	111·92	37·94	73·98	73·04	41·72	31·32
Winter	91·22	28·04	63·18	61·70	33·44	28·26
Spring	124·52	34·34	90·18	75·02	39·56	35·46
Extremes	158·00	14·54	143·46	97·34	21·92	75·42

STATISTICS.

Census Results, 1881.

The Colony of New Zealand was founded in 1839. Since that period the census has been taken nine times. While seven years elapsed between the first and second census, the succeeding enumerations were taken at intervals of about three years.

Population.

The following table exhibits the population, exclusive of the aborigines, when each census was taken:—

Date of Enumeration.	Population.			Centesimal Increase.	Number of Inhabited Houses.
	Persons.	Males.	Females.		
December, 1851	26,707	15,035	11,672	...	...
December 24, 1858 ...	59,413	33,679	25,734	122·46	12,812
December, 1861	99,021	61,062	37,959	39·99	22,398
December, 1864	172,158	106,580	65,578	73·86	37,996
December, 1867	218,668	131,929	86,739	27·01	54,015
February, 1871	266,986	156,431	110,555	17·25	57,182
March 1, 1874	341,860	194,349	147,511	16·82	61,356
March 3, 1878	414,412	230,998	183,414	38·36	79,657
April 3, 1881	489,933	269,605	220,328	18·22	92,833
Increase from 1871 to 1881	...	...	...	83·51	...

In the above numbers the military and their families have not been included, as they did not constitute a portion of the settled population of the colony, and have now been all removed.

Nationalities.

The nationalities composing the above population on the 3rd April, 1881, were as follow:—

English and Welsh	121,187
Scotch	52,753
Irish	49,363
Australian	17,277
New-Zealand-born (white)	223,404
Other British possessions	5,339
Foreign	19,777
Uncertain	833
	489,933

Proportion between the Sexes.

In March, 1878, there were 79·40 females to every 100 males, but in that proportion the Chinese people were included, but, as they do not come to the colony with a view to permanent settlement, and do not bring their women with them, a juster estimate of the general

population would be made by estimating the proportion exclusive of the Chinese. The proportion thus arrived at would be 100 males to 80·98 females.

In April, 1881, there were 100 males to 81·72 females, and excluding Chinese the proportions were 100 males to 82·88 females, showing a marked movement towards the numerical equalization of the sexes.

Number of Chinese.

The number of Chinese in April 1881 amounted to 5,033, of whom 16 were females.

Density of Population.

The population of the colony, exclusive of Maoris, amounted, in April, 1881, to 4·693 persons to a square mile; but, as 187,439 persons resided in towns, the population outside the towns, numbering 302,494, only amounted to 2·89 persons to a square mile.

The progress made in the settlement of the colony under the influence of the Public Works system is shown by the density of the population to a square mile in 1871 and 1881. This was as follows:—

	Persons to a Square Mile.
1871	2·456
1881	4·693

The relative advance in the different provincial districts for the same period is seen by a comparison of the two following tables:—

	Persons to a Square Mile in 1871.		Persons to a Square Mile in 1881.
Canterbury ...	3·446	Canterbury ...	8·259
Westland ...	3·227	Wellington ...	5·611
Otago ...	2·773	Otago ...	5·350
Auckland ...	2·347	Taranaki ...	4·152
Wellington ...	2·194	Hawke's Bay ...	3·768
Nelson ...	2·057	Auckland ...	3·744
Hawke's Bay ...	1·315	Westland ...	3·154
Marlborough ...	1·309	Nelson ...	2·384
Taranaki ...	1·252	Marlborough ...	2·325

The average number of persons to an inhabited dwelling throughout the colony was 5·12 in 1881, against 5·02 in 1878, 4·88 in 1874, 4·48 in 1871, and 4·05 in 1867. But, while the average number of persons to each dwelling was on the increase, the average character of the dwellings was evidently improving, and their capacity for occupation by a larger number of persons becoming greater.

Number and Description of Dwellings.

The following table will show the increase or decrease in the

number and description of the dwellings containing respectively one or two rooms, three or four rooms, and five or more rooms :—

—	Total Number of Inhabited Dwellings, including Tents.	Number of Inhabited Dwellings containing			
		One or Two Rooms, including Tents.	Three or Four Rooms.	Five or more Rooms.	Number o Rooms not stated.
1881	95,750	24,835	35,064	34,682	1,169
1878	82,588	24,034	29,223	27,616	1,715
1874	61,356	19,612	21,027	19,679	1,038

In addition to the 95,750 inhabited dwellings, there were 6,737 unoccupied dwellings and 848 dwelling-houses that were being built. Of this total of 103,335 dwellings, 4,062 were built of brick or stone, 87,646 of wood and iron, 2,482 of sod or similar material, 370 of raupo (viz., a framework thatched with raupo or bulrush), 2,207 were described as huts of sod, clay, wood, or stone, and 2,917 were tents or dwellings with canvas roofs. The materials of 1,350 dwellings were not specified.

Comparative Populations of Cities and Towns.

There were, in 1881, 169 defined boroughs or towns. Of these,—

2	contained	... ...	upwards of 20,000
2	,,	... ...	15,000 to 20,000
4	,,	... ...	5,000 ,, 10,000
18	,,	... ...	2,000 ,, 5,000
20	,,	... ...	1,000 ,, 2,000
29	,,	... ...	500 ,, 1,000
40	,,	... ...	100 ,, 500

The following are some of the principal towns with their population in 1881. As the population of Dunedin, Christchurch, and Auckland cannot fairly be estimated without taking the suburbs into account, these have also been included :—

Names and Population of Principal Cities and Towns, including Suburbs.

Dunedin and suburbs ...	42,794	Lyttelton	4,127
Auckland and suburbs	30,952	Timaru	3,917
Christchurch and suburbs	30,715	New Plymouth ...	3,310
Wellington	20,563	Hokitika	2,600
Nelson	6,764	Greymouth	2,544
Oamaru	5,791	Masterton	2,241
Napier	5,756	Onehunga	2,217
Thames	4,863	Port Chalmers ...	2,181
Wanganui	4,646	Blenheim	2,107
Invercargill	4,596		

Ages of the People.

Of the 489,933 persons enumerated on the 3rd April, 1881, 9,209 males and 8,745 females were infants under the age of one year. There were, including these infants, 82,289 under five years of age, viz., 41,636 males and 40,653 females. The numbers at the ages usually recognized as the school ages, *i.e.*, five and under fifteen years, amounted to 125,537, viz., 63,180 boys and 62,357 girls. The total number under fifteen years of age was thus 207,746, viz., 104,816 males and 103,010 females. There were 25,225 youths and 25,723 young women, or a total of 50,948 persons at the ages of fifteen to twenty-one. Thus, while during the first year of age there were 100 males to 94·96 females, there were 100 males under twenty-one years of age to 98·99 females at the same age. The children under five years of age amounted to 16·84 per cent. of the population, the children of five and under fifteen years amounted to 25·69 per cent., and the young persons of fifteen and under twenty-one years of age amounted to 10·43 per cent., the total number of persons under twenty-one years of age amounting to 52·82 per cent. of the population. The total number of persons of twenty-one years and under forty was 141,769, viz., 82,349 males and 59,420 females. The persons of forty years of age and under sixty-five numbered 81,163, viz., 52,288 males and 28,875 females. The number at sixty-five years of age and upwards amounted to 6,895, 3,957 being males and 2,938 females. There were 544 persons, viz., 306 males and 238 females, between eighty and ninety years of age, 12 males and 16 females between ninety and ninety-three years of age, 4 males and 6 females between ninety-three and ninety-seven years of age, 2 males between ninety-seven and one hundred, and 2 males between one hundred and four and one hundred and five years of age.

GENERAL SUMMARY OF AGES OF POPULATION.

TABLE showing the NUMBER of PERSONS, MALES and FEMALES (exclusive of Maoris), living at Three Periods of Ages.

	NUMBERS.		
	Persons.	Males.	Females.
All ages	489,933	269,605	220,328
Specified ages	488,601	268,635	219,966
Up to twenty years	250,435	125,876	124,559
From twenty to sixty years ...	224,932	134,993	89,939
Over sixty years	13,234	7,766	5,468
Unspecified	1,332	970	362

The Chinese included in the above numbers amounted to 5,004 persons, viz., 4,995 males and 9 females.

Religions.

Out of a population of 489,933, the persons who objected to state their religious belief amounted to 13,978. No entry was made in the column for "Religion" in the household schedules opposite the names of 1,329 persons.

The following table gives a summary of the numbers of each religious denomination:—

Religious Denomination.	Persons.	Males.	Females.
Church of England, and Protestants not otherwise defined	203,333	111,653	91,680
Presbyterians	113,108	61,543	51,565
Methodists, &c.	46,657	23,845	22,812
Baptists	11,476	5,785	5,691
Congregational Independents	6,699	3,449	3,250
Lutherans	5,773	3,703	2,070
Unitarians	489	331	158
Society of Friends	232	153	79
Roman Catholics, and Catholics undefined	68,984	36,963	32,021
Hebrews	1,536	844	692
Pagans	4,936	4,931	5
Otherwise described	11,403	6,707	4,696
Undescribed	1,329	950	379
Objecting to state their religion ...	13,978	8,748	5,230

The Protestants of all denominations amounted to 387,767; the Catholics, including the Greek Church, to 69,039. Of the Protestant denominations, the members of the Church of England (including Protestants not otherwise defined) amounted to 203,333, or 41·50 per cent. of the population. The Presbyterians numbered 113,108, or 23·08 per cent., and the Methodists numbered 46,657, or 9·53 per cent. of the population. The Roman Catholics numbered 68,984, or 14·08 per cent. of the population. Of the principal denominations, the proportions to 100 of the population were respectively in 1878 and 1881 as follow:—

	1878.	1881.
Church of England	42·55	41·50
Presbyterians	22·95	23·08
Roman Catholics	14·21	14·08
Methodists	9·40	9·53

Of the smaller bodies, the Baptists increased from 9,159, or 2·21 per cent., to 11,476, or 2·34 per cent.; the Congregational Independents varied from 5,555, or 1·34 per cent., to 6,699, or 1·37 per cent.; the Lutherans from 5,643, or 1·36 per cent., to 5,773, or 1·18

per cent.; and Hebrews from 1,424, or 0·34 per cent., to 1,536, or 0·31 per cent.

Allegiance.

The number of British subjects in the colony in 1881 amounted to 471,726, or 96·28 per cent. of the population whose allegiance could be ascertained. In this number were included all persons born in British possessions, all naturalized British subjects, persons having British names born at sea, and those whose birthplaces were not given, but who had British names. The foreign subjects amounted to 18,043, or 3·68 per cent. of the population, against 4·48 per cent. in 1878.

Numbers born in the Colony.

The persons in New Zealand in April, 1881, who were born in the colony numbered 223,404: of these, 112,404 were males, and 111,000 were females. The total amounted to 45·6 per cent. of the whole population. The number of New-Zealand-born in 1878 was 174,126, or 42·02 per cent. of the whole population. There has thus been an increase since March, 1878, of 49,278, or 28·3 per cent., on the New-Zealand-born population. The number of New-Zealand-born in 1874 amounted to 122,635 persons. The increase, therefore, in the seven years was 100,769, or 82·16 per cent. The population as given does not include the Maoris.

Numbers born outside the Colony.

The Australian-born were 17,277 in 1881, an increase in the three years of 1,186, or 7·37 per cent.; the English-born increased from 108,195 in 1878 to 121,187 in 1881, or 12 per cent.; the Scotch increased from 47,949 to 52,753, or 10·02 per cent.; the Irish increased from 43,758 to 49,363, or 12·8 per cent.; and foreigners increased from 18,505 to 19,777, or 6·87 per cent.

Conjugal Condition of the People.

In 1881, out of every 100 of the male population (excepting Chinese), 27·73 were married and 70·39 were single; and, of the female population, in every 100, 33·05 were married and 63·64 were single. The proportion of married males has thus decreased from 28·06 per cent. in 1878 to 27·73 per cent. in 1881, and the proportion of married females from 34·32 per cent. in 1878 to 33·05 per cent. in 1881. The decrease in the proportion of married persons is attributable to the increase in the number of persons under twenty-one years of age. The total population under twenty-one amounted in 1881 to 258,774 persons, or 52·82 per cent. of the whole population,

against 51·94 per cent. in 1878, and 50·29 per cent. in 1874. 185,941 males were returned in 1881 as unmarried: of these, 125,818 were under twenty years of age, and 60,123 over twenty years of age. Of the females, 140,184 were unmarried, of whom 103,058 were under fifteen years of age, and 37,126 over fifteen.

There were thus 22,997 bachelors over twenty years of age in excess of the number of spinsters over fifteen years of age. To every 100 spinsters over fifteen years of age there were therefore 162 bachelors; the proportions in 1878 having been 191 bachelors to 100 spinsters at those ages. Of the 37,126 spinsters over fifteen years old, 20,309 were from fifteen to twenty years of age, 10,170 from twenty to twenty-five years of age, and 6,647 over twenty-five years of age.

The husbands in 1881 numbered 73,261, the wives 72,804, the husbands being most numerous by 457. There was an excess of husbands over wives in every district except Wellington and Otago, where the wives were most numerous, in the latter place by 44 and in the former by 141.

The widows amounted to 7,296, being in excess of the widowers by 2,332, the latter only amounting to 4,964. The widows were more numerous than the widowers at all ages. Under thirty years of age the widows numbered 422, the widowers 183; from thirty to fifty years of age the widows numbered 2,851, the widowers 1,983; at the age of fifty and upwards the widows were 4,023, the widowers 2,798. Thus to every 100 widows under thirty years of age there were 43 widowers; at the ages thirty to fifty, to every 100 widows there were 69 widowers; and at fifty years of age and upwards, to every 100 widows there were 69 widowers; the proportion of widows to widowers being greater at all ages in 1881 than in 1878.

The number of married women in the colony in 1881 between fifteen and forty-five years of age was 57,458.

Legitimate Births.

The number of legitimate births in the twelve months ending the 30th September, 1881, was 18,308. On an average one child was born to every married woman between fifteen and forty-five every 3·14 years. In England, the legitimate births in 1870 amounted to 748,050, or 28·76 births to every 100 married women at fifteen to forty-five, or one birth to each such married woman in 3·48 years. The married women comprised in the age-period fifteen to forty-five are generally younger than the married women of the same age-period in England. Taking the whole number of married women in each country between the ages fifteen to forty-five as a basis of comparison, the following figures

show the proportions per cent. at the respective ages in England and New Zealand :—

PROPORTION to 100 MARRIED WOMEN at the Ages Fifteen to Forty-five.

Ages.	England.	New Zealand.		
		1874.	1878.	1881.
Under 20	1·33	2·37	2·44	2·14
20 to 40	80·01	83·70	82·39	81·10
40 to 45	18·66	13·93	15·17	16·76

Education of the People.

The information required to be given on the household schedule was, as to the measure of education, limited to "Reading and writing," "Reading only," or "Not able to read." The Chinese have not been included in the tables relating to education. Only those Chinese who were able to read and write English were to be enumerated as able to read and write. Of the 5,004 Chinese in the colony, 102 males and 2 females were returned as being able to read and write, and 11 males and 1 female as being able to read only. Dealing with the population, exclusive of Maoris and Chinese, except for the census years previous to 1867, when the number of Chinese was not separately shown, it appears that in 1881 71·32 per cent. could read and write, 5·63 could read only, and 23·05 per cent. could not read.

Percentage of Population able to read and write.

Year.	Per cent.
1861	68·67
1864	72·70
1867	71·35
1871	69·20
1874	68·15
1878	69·52
1881	71·32

The rate having been lowest in 1874 is attributable to the fact that in the earlier periods the proportion of males from twenty-one to forty years of age was greater than in that year, and in 1874 the proportion of children under ten years of age was greater than in the preceding years; the proportions in 1864 and 1874 respectively of persons of those ages having been to the whole population as follows :—

Under Ten Years.	Per cent.	Twenty-one to Forty Years.	Per cent.
1864	26·37	1864	44·53
1874	32·36	1874	32·51

The percentage of females who could read and write was at each of the census periods considerably less than the percentage of males

who could read and write. In 1881, while 73·31 per cent. of the males could read and write, only 68·94 per cent. of the females could read and write. The percentage of females able to read and write was less at all quinquennial periods of age, except at the periods five to ten, ten to fifteen, and fifteen to twenty years, when it was slightly in excess of the similar percentage of the males.

School Attendance.

In 1881 87,811 children attended Government schools, against 62,866 in 1878; 13,538 attended private schools, against 14,611 in 1878; 78,891 attended Sunday-schools, against 62,273 in 1878; and 7,348 were receiving tuition at home, against 9,706 in 1878. The number of children at what is generally defined as the school-going age, five to fifteen, was 125,527, but the above numbers of those attending school also include children under five years and over fifteen who were attending school.

While the population at five to fifteen years increased 19·27 per cent. between 1878 and 1881, the numbers attending school during the same period increased 30·81 per cent. The proportion of children attending school to the total number of children at the ages five to fifteen was 66·78 per cent. in 1874, 73·64 per cent. in 1878, and 80·76 per cent. in 1881.

INDUSTRIES AND MANUFACTURES.

NUMBER and DESCRIPTION of MANUFACTORIES, WORKS, &c., in operation in New Zealand, April, 1881.

—	Number of Establishments.	Hands employed.	Approximate Value of Land and Buildings.	Approximate Value of Machinery and Plant.
			£	£
PRINTING ESTABLISHMENTS	106	1,779	99,449	129,717
MUSICAL-INSTRUMENTS FACTORY ...	1	3	...	...
MACHINES, TOOLS, IMPLEMENTS—				
Agricultural-implements factories ...	23	315	27,582	16,272
Machinists and millwrights	8	90	6,690	6,703
CARRIAGES AND HARNESS—				
Coach-building and -painting works ...	49	387	35,570	10,760
SHIPS AND BOATS—				
Ship- and boat-building works ...	25	100	8,068	2,500
Block and pump factories	3	6	1,800	1,300
Patent slips	4	31	6,700	30,220
FURNITURE—				
Furniture factories	45	464	71,415	4,512
Chair and washboard factories ...	3	8	1,075	470
Bellows factory	1	5	...	...
CHEMICALS—				
Chemical works	2	12	...	...
Cleaning and dyeing works	10	26	4,170	655
Hæmatite-paint factories	2	4	...	...
TEXTILE FABRICS—				
Woollen mills	4	417	36,000	62,500
Ornamental-silk factory	1	1	...	...

NUMBER and DESCRIPTION of MANUFACTORIES, &c.—*continued.*

—	Number of Establishments.	Hands employed.	Approximate Value of Land and Buildings.	Approximate Value of Machinery and Plant.
DRESS—			£	£
Boot factories	31	1,299	33,100	13,267
Clothing factories	8	756	6,200	2,480
Hat and cap factories	8	58	3,892	1,190
Oilskin factories	5	19	...	...
Stocking-weaving factories	2	2	...	...
FIBROUS MATERIALS—				
Flaxmills	40	284	...	...
Rope and twine works	18	124	9,735	8,285
Sail factories	13	37	6,038	130
ANIMAL FOOD—				
Meat-preserving works. Included with Boiling-down. *See* ANIMAL MATTERS.				
Bacon-curing factories	20	64	10,030	1,060
Fish-curing factories	14	68	2,655	905
VEGETABLE FOOD—				
Grain mills	131	450	207,085	150,093
Biscuit factories	18	148	18,380	9,965
DRINKS AND STIMULANTS—				
Aërated water and cordial factories	79	228	36,201	30,700
Breweries	99	526	233,218	84,180
Coffee, spice, and chicory works	9	63	16,700	5,650
Malthouses	34	67	47,850	666
Sauce and pickle factories	3	15	800	900
Colonial-wine factories	5	15	825	75
ANIMAL MATTERS—				
Boiling-down and meat-preserving works	40	468	62,525	34,320
Bone-cutting mills	17	25	6,500	5,195
Brush factory	1	24	...	...
Glue factories	2	4	...	...
Portmanteau factory	1	2	...	...
Soap and candle works	15	108	15,550	17,690
Fellmongering, tanning, currying, and woolscouring works	119	859	88,156	47,926
VEGETABLE MATTERS—				
Chaff-cutting works	38	100	13,476	3,980
Sawmills and sash and door factories	223	4,238	397,084	376,544
Paper mill	1	10	...	...
Starch works	2	6	...	...
COAL—				
Collieries	51	992	100,071	121,079
Gasworks	17	188	177,749	314,367
STONE, CLAY, AND EARTHENWARE—				
Brick, tile, and pottery factories	127	685	77,030	28,735
Limeworks	23	63	4,560	2,020
Glass factory	1	...	...	...
Stone quarries (building)	10	136	16,533	2,160
Stone-sawing works	1	8	...	...
METALS—				
Quartz-mining (gold) works	84	1,147	...	...
Mining (manganese) works	2	19	...	...
Iron and brass foundries	35	953	83,581	71,686
Spouting and ridging factories	9	20	2,500	1,895
Totals, 1881	1,643	17,938	*1,993,330	*1,612,141
Totals, 1878	1,271	14,177	*1,761,694	*1,289,378

* These amounts represent the total values, including the values of certain industries the particulars of which are left blank in the table, not being published for sufficient reasons.

OCCUPATIONS.—I. MALES.

TABLE showing the POPULATION and OCCUPATIONS of the MALE SEX of the COLONY and PROVINCIAL DISTRICTS of NEW ZEALAND, by CENSUS taken on the 3rd APRIL, 1881.

Class.	Order.	Occupations (arranged in Fifteen Orders).	The Colony.	Auckland.	Taranaki.	Wellington.	Hawke's Bay.	Marlborough.	Nelson.	Westland.	Canterbury.	Otago.	Chatham Islands.
		Total male population	269,605	54,111	8,517	32,717	9,700	5,249	14,800	9,675	60,590	74,685	161
		Total of specified occupations	267,808	...	...	...	...	...	...	...	...	...	...
PROFESSIONAL ... I.	I.	Persons engaged in the general or local government, or the defence or protection of the country	2,946	584	595	552	86	35	114	83	392	497	2
	II.	Persons engaged in the learned professions, or in literature, art, science (with their immediate subordinates)	4,763	1,060	136	657	196		215	130	1,043	1,240	3
DOMESTIC ... II.	III.	Persons engaged in domestic offices or duties, children, relatives (not otherwise returned)	102,068	20,211	3,047	13,121	3,618	1,954	5,336	2,905	24,027	27,817	32
	IV.	Persons engaged in entertaining and performing personal offices for man	4,904	1,034	166	679	270	79	248	214	1,032	1,179	3
COMMERCIAL ... III.	V.	Persons who buy and sell, keep or lend money, houses, or goods of various kinds	9,209	2,031	225	1,431	326	98	341	246	1,952	2,554	5
	VI.	Persons engaged in the conveyance of men, animals, goods, and messages	11,329	2,842	249	1,390	485	200	482	335	2,319	2,984	43
AGRICULTURAL ... IV.	VII.	Persons possessing, working, or cultivating land; raising or dealing in animals; or following pursuits subsidiary thereto	53,769	11,123	2,040	6,377	2,286	1,400	2,674	453	12,808	14,544	64
INDUSTRIAL ... V.	VIII.	Persons engaged in working and dealing in art and mechanic productions in which matters of various kinds are employed in combination	17,439	3,996	533	2,348	618	258	578	304	4,198	4,602	4
	IX.	Persons working and dealing in textile fabrics, dress, and in fibrous materials	6,389	1,453	116	724	196	89	269	164	1,482	1,896	...
	X.	Persons working and dealing in food and drinks	6,871	1,370	178	851	250	92	308	218	1,705	1,894	...
	XI.	Persons working and dealing in animal and vegetable substances ...	4,853	2,228	95	517	202	195	174	73	466	902	1
	XII.	Persons working and dealing in minerals	22,698	3,689	354	898	249	355	3,267	3,553	2,142	8,191	...
INDEFINITE and NON-PRODUCTIVE } VI.	XIII.	Labourers and others (branch of labour undefined)	17,786	1,404	656	2,780	752	367	614	258	5,761	5,191	3
	XIV.	Persons of property and rank (not returned under any office or occupation)	278	81	9	39	12	5	18	2	46	65	1
	XV.	Persons supported by the community, and of no specified occupation	2,512	586	54	216	88	10	74	115	678	691	
		Occupation not stated	1,797	419	64	137	66	29	88	22	539	433	...

OCCUPATIONS.—II. FEMALES.

TABLE showing the POPULATION and OCCUPATIONS of the FEMALE SEX of the COLONY and PROVINCIAL DISTRICTS of NEW ZEALAND, by CENSUS taken on the 3rd APRIL, 1881.

Class.	Order.	Occupations (arranged in Fifteen Orders).	The Colony.	Auckland.	Taranaki.	Wellington.	Hawke's Bay.	Marlborough.	Nelson.	Westland.	Canterbury.	Otago.	Chatham Islands.
		Total female population	220,328	45,340	6,341	28,654	7,667	4,051	11,275	5,935	51,592	59,392	81
		Total of specified occupations	220,312	...	...	...	...	...	...	...	...	...	...
I.	I.	Persons engaged in the general or local government, or the defence or protection of the country	23	4	1	1	...	...	3	3	6	5	...
	II.	Persons engaged in the learned professions, or in literature, art, science (with their immediate subordinates)	2,507	617	58	344	116	19	133	74	602	544	...
II.	III.	Persons engaged in the domestic offices or duties of wives, mothers, mistresses of families, children, relatives (not otherwise returned)	194,538	40,188	5,827	25,465	6,673	3,637	10,127	5,313	45,063	52,174	71
	IV.	Persons engaged in entertaining and performing personal offices for man	15,034	2,665	324	2,008	670	267	656	349	3,958	4,130	9
III.	V.	Persons who buy and sell, keep or lend money, houses, or goods of various kinds	439	104	13	41	7	6	25	11	97	135	...
	VI.	Persons engaged in the conveyance of men, animals, goods, and messages	44	10	1		1	...	4	1		7	...
IV.	VII.	Persons possessing, working, or cultivating land; raising or dealing in animals; or following pursuits subsidiary thereto	678	157	24	58	29	52	18	...	151	189	...
V.	VIII.	Persons engaged in working and dealing in art and mechanic productions, in which matters of various kinds are employed in combination	163	25	...	37	3	2	7	...	35	54	...
	IX.	Persons working and dealing in textile fabrics, dress, and in fibrous materials	5,541	1,273	77	548	130	63	224	141	1,332	1,752	1
	X.	Persons working and dealing in food and drinks	192	56	7	24	8	2	12	7	35	41	...
	XI.	Persons working and dealing in animal and vegetable substances	19	12	...	1	...	...	...	...	3	3	...
	XII.	Persons working and dealing in minerals	12	...	...	...	...	...	...	1	...	11	...
VI.	XIII.	Labourers and others (branch of labour undefined)	36	9	...	5	...	...	4	3	8	7	...
	XIV.	Persons of property and rank (not returned under any office or occupation)	121	32	5	22	8	2	7	...	23	22	...
	XV.	Persons supported by the community, and of no specified occupation	964	186	3	83	16	3	53	32	271	317	...
		Occupation not stated	16	2	1	2	6	...	...	...	4	1	...

Maori Population.

The total number of Maoris was in 1878 estimated at 42,814, the greater number being in the North Island, only a few living in the South and its adjacent islands. In 1881 the census returns gave 44,097 as the total number.

The number of the principal tribes is twenty: of these, the Ngapuhi is the strongest; the Waikatos rank next in point of numbers; the Ngatikahungunu is third; then the Ngatiporou and the Arawas. Of the Maoris in the colony, 24,368 were stated to be males, and 19,729 to be females.

As much difference of opinion has existed as to whether the numerical decline of the Maori race has not been, at any rate in certain districts, arrested, it may be interesting to compare, so far as they are given, the ages of the Maoris with the ages of the settled and steadily increasing population of England. The numbers and sexes of some of the Maori tribes have been imperfectly given. It is therefore necessary to deal only with those tribes for which full information as to numbers, ages, and sexes is given. This was the case in respect of the numbers belonging to thirteen of the principal tribes, amounting in the whole to 31,645, according to an account taken in the year 1874. Of these, 6,079 were males under fifteen, and 5,225 were females under fifteen. The males over fifteen amounted to 11,209, and the females over fifteen to 9,132. There was a total excess of males over females of 2,931, or to every 100 males there were 83·05 females. In England, in 1871, the males under fifteen amounted to 37·15 per cent. of the whole male population; the Maori males, of the tribes given, in 1881, under the age of fifteen, amounted to 33·78 per cent. of the whole male population of those tribes. The females of similar ages were, respectively, in England 35·13 per cent. of the whole female population, and among the Maoris 34·15 per cent. If the numbers of the males and females under fifteen be respectively compared, the following result is shown:—

Proportions per Cent. to the whole Population.

Age.	England.	N.Z. European.	Maoris.
Males under fifteen	18·09	21·61	18·43
Females under fifteen ...	18·03	21·24	15·35

To draw any conclusion from these figures, it would be necessary to have more exact information as to the numbers of the Maoris living at the various higher age-periods, but the information has only been given for the periods under and over fifteen.

The existence among some tribes of the Maoris of a higher proportion of females under fifteen (ultimately to become wives and

mothers) to the total female population than obtains in England (the percentage under fifteen to the total females being respectively 40·03 in the Ngapuhi, 41·12 in the Arawa, and 46·15 in the Urewera, while it is only 35·13 per cent. in England), might at first sight lead to the belief that the decline in the numbers of the race had been arrested, and that even an increase might be expected. This is not the case, however, as there are causes in operation which increase the mortality of the adult Maoris without increasing the mortality of the children, so that the actual proportion of children to the whole population would be thereby much greater, and an appearance of productiveness shown which did not really exist.

Do such causes exist? Does the fact of the partial adoption by the adult Maori of civilized habits and costume, and the continual reversion to the habits and costume of barbarism, with a system rendered more susceptible to external influences, especially those of a humid and changeable climate, tend to promote the spread of disease, notably of tubercular diseases, and consequent mortality? Does the spread of drinking habits tend to shorten the life of the adult Maori? These and other similar questions have an important bearing on the subject.

The examination of the numbers of some of the tribes points rather to the conclusion that some such causes of mortality among the adults do exist. In the return for a former year the Ngatikahungunu show 41·91 per cent. of the males and 41·21 per cent. of the females as being under fifteen years of age. The Arawa show 40·58 per cent. of the males and 48·30 per cent. of the females as being under fifteen.

It is hardly conceivable that the women of these tribes should have been so exceedingly prolific, and that, as in the case of the Arawa, nearly one-half of the female population should have been under fifteen, unless a large number of adult women had died before reaching middle age, thereby increasing the proportion of younger females by reducing the proportion of the adults.

It may be noticed in connection with this subject that in 1871 the Maoris were estimated at 37,502, and in 1867 at 38,540; while in 1874 they were estimated at 45,470, in 1878 at 42,819, and in 1881 at 44,097. The estimates formerly made were, however, from the then state of feeling in the Maori population, necessarily much more imperfect and unreliable than those recently made.

Occupations of the Chinese.

The Chinese at the census of 1881 numbered 5,033, of whom sixteen were women. As special legislation has taken place with

regard to them, the following statistics are given of their principal occupations:—

Gold-miners	3,858
Farmers or market-gardeners	298
Farm servants and labourers	60
Gardeners	95
Rabbiters	53
Cooks	56
Servants	56
Shopkeepers	85
Hawkers	33
Labourers	133
Inmates of charitable institutions ...	18
Prisoner	1
Various occupations	347
	5,033

Vital Statistics.

The estimated population of the colony on the 31st December, 1881, amounted to 500,910. These figures do not include the aboriginal natives, who numbered about 44,097. If that number be added to the rest of the population, there would thus be given a total of 545,007 inhabitants at that date.

Birth-rate.

The children born alive and registered in 1881 amounted to 18,732, or at the rate of 37·95 per 1,000 of the population. This is the lowest rate for the whole colony yet recorded. The average birth-rate in England for the ten years 1868–77 was 35·7 per 1,000. As in the English population the females are more numerous than the males, while in New Zealand the males are largely in excess of the females, to compare the birth-rate in the colony with the birth-rate in England the rate should rather be estimated on a total population of which the males do not exceed the females. Deducting from the population the surplus males, the birth-rate in New Zealand in 1881 would have been at the rate of 41·46 per 1,000 of equal males and females.

Illegitimate Births.

These births registered in 1881 numbered 534, or 2·85 per cent. of the births registered. This is far lower than the rates in England

or Scotland, the rates in the former country being 5·2, and in the latter 8·6, in 1878.

Marriage-rate.

The marriages in 1881 numbered 3,277, the number of persons married being at the rate of 13·28 per 1,000 of the population. This is somewhat lower than the average rate in England for the decade 1868–77, which was 16·6.

Death-rate.

The death-rate in 1881 amounted to 11·13 per 1,000 of the population. The death-rate in England for 1878 was 23·8, the average rate for the ten years ending 1877 being 21·9.

The following table shows the number and proportion of births, marriages, and deaths for the last ten years. An opportunity of comparing the rates in New Zealand with the rates in the Australian Colonies is afforded by the diagrams at the end of this book:—

PROPORTION OF BIRTHS, MARRIAGES, AND DEATHS TO THE POPULATION.
(Decennial Return.)

Year.	Estimated Mean Population of New Zealand.	Numerical.			Proportion to every 1,000 of Population.		
		Births.	Marriages.*	Deaths.	Births.	Marriages.*	Deaths.
1872	273,273	10,795	1,873	3,192	39·50	6·85	11·68
1873	287,752	11,222	2,276	3,645	38·99	7·90	12·66
1874	320,687	12,844	2,828	4,161	40·05	8·81	12·97
1875	358,858	14,438	3,209	5,712	40·23	8·94	15·92
1876	387,465	16,168	3,196	4,904	41·73	8·25	12·66
1877	408,348	16,856	3,114	4,685	41·28	7·62	11·47
1878	423,465	17,770	3,377	4,645	41·96	7·97	10·96
1879	448,124	18,070	3,352	5,583	40·32	7·48	12·46
1880	474,296	19,341	3,181	5,437	40·78	6·71	11·46
1881	493,482	18,732	3,277	5,491	37·95	6·64	11·13

Of the deaths in 1881, 2,440, or 44·44 per cent., were of children under five years of age.

Sexes of Deceased Persons.

Of the deaths, 3,247 were of males, and 2,244 of females, which, upon the estimated mean number of each sex living in the year, gives a rate of mortality among the males of 11·81 per 1,000, and among the females of 9·93 per 1,000.

Causes of Death.

The following table gives the classification of diseases which have

* The number of persons married, and the number married in proportion to every 1,000 of the population, may be ascertained by doubling the numbers in these two columns.

terminated fatally, with the percentage of each class and order of disease to the total mortality from 1874 to 1881 :—

Classes.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.
I. Zymotic Diseases.								
Order 1. Miasmatic diseases	26·92	26·84	23·43	21·62	18·13	22·00	19·15	19·43
„ 2. Enthetic „	·14	·28	·23	·34	·34	·27	·31	·24
„ 3. Dietic „	1·85	2·05	2·18	2·54	2·23	2·18	2·26	2·00
„ 4. Parasitic „	·41	·87	·71	·60	·78	·70	·66	·71
	29·32	30·04	26·55	25·10	21·48	25·15	22·38	22·38
II. Constitutional Diseases.								
Order 1. Diathetic diseases	2·93	2·38	3·24	2·20	3·01	3·06	3·15	3·33
„ 2. Tubercular „	9·40	9·82	9·95	10·93	11·04	10·52	11·86	12·39
	12·33	12·20	13·19	13·13	14·05	13·58	15·01	15·72
III. Local Diseases.								
Order 1. Nervous diseases	10·67	9·61	9·40	10·89	11·18	10·48	9·91	10·71
„ 2. Circulation, diseases of	4·71	4·83	5·26	5·44	5·96	5·25	6·24	5·76
„ 3. Respiratory organs, diseases of ...	12·28	12·87	9·99	10·26	10·84	13·02	11·94	12·19
„ 4. Digestive „ „ ...	6·37	6·21	7·04	6·72	7·70	6·32	7·15	7·76
„ 5. Urinary „ „ ...	·99	1·09	1·24	1·45	1·79	1·49	1·58	1·79
„ 6. Generative „ „ ...	·26	·12	·20	·26	·24	·27	·29	·40
„ 7. Locomotive „ „ ...	·22	·12	·18	·26	·15	·21	·35	·26
„ 8. Integumentary system „ ...	·53	·25	·63	·43	·29	·16	·26	·18
	36·03	35·10	33·94	35·71	38·15	37·20	37·72	39·05
IV. Developmental Diseases.								
Order 1. Children, diseases of	4·80	4·76	6·73	5·70	5·49	5·15	6·09	5·08
„ 2. Adults „	1·47	1·21	1·33	1·45	1·90	1·04	1·27	1·53
„ 3. Old people „	1·32	1·32	1·49	1·52	2·48	1·99	1·88	2·17
„ 4. Nutrition „	5·58	6·16	5·63	5·61	5·41	5·68	5·42	5·28
	13·17	13·45	15·18	14·28	15·26	13·86	14·66	14·06
V. Violence.								
Order 1. Accident or negligence	7·31	6·86	8·32	9·63	9·17	8·27	8·33	7·52
„ 2. Homicide	·07	·26	·25	·30	...	·11	·20	·07
„ 3. Suicide	·48	·51	·86	·68	·11	·75	·70	·77
„ 4. Execution	·02	·02	...	·04	·81	·02	·02	...
Violent deaths not classed ...	...	·18	...	...	...	...	...	...
	7·88	7·83	9·42	10·65	9·09	9·15	9·25	8·36
Causes of death not specified	1·27	1·38	1·71	1·13	·95	·96	·76	·33
Abscess not defined	...	...	...	...	...	·09	·22	·10

Hospitals.

There were in 1881 37 hospitals in the colony, into which 3,918 males and 1,205 females were admitted as patients during the year. The total number relieved as out-door patients during the year was over 15,000. During the same period 305 males and 75 females died in the hospitals. There was provision in these hospitals for 812 males and 341 females, or a total of 1,153 beds. The aggregate number of

cubic feet of space amounted to 1,529,933, or an average of 1,326 cubic feet to each bed.

Lunatic Asylums.

There are 7 lunatic asylums in the colony, which contained, at the end of the year 1881, 762 males and 396 females, being an increase of 38 male and 8 female patients upon the number at the beginning of the year. Of the above 1,158 patients, 625 males and 308 females were supposed to be incurable: 233 males and 132 females were admitted, 144 males and 110 females were discharged, and 49 males and 14 females died during the year. The asylums in the aggregate afforded accommodation for 1,157 persons (753 males and 404 females), with an average of nearly 647 cubic feet of space for each patient.

The proportion of lunatics to the general population, exclusive of Maoris, on the 3rd April, 1881, the day of the last census being taken, was ... ... 1 to 437

In England, December, 1877, it was	...	...	1	„ 362
In Victoria	„	...	1	„ 313
In New South Wales	„	...	1	„ 362
In Tasmania	„	...	1	„ 317

Deaf-and-Dumb.

One hundred and fourteen persons were tabulated under this head, 60 males and 54 females. Of these, 55 were under fifteen years of age, and 17 between fifteen and twenty. In the Institution at Sumner, maintained by Government, 24 children are now being educated.

Blind.

One hundred and thirty-eight persons, viz., 79 males and 59 females, were returned as being blind. Of these, 23 were under twenty years of age, 25 between twenty and forty, 36 between forty and sixty, and 54 over sixty.

Immigration and Emigration.

Up to the end of the year 1870 the conduct of New Zealand immigration was entirely in the hands of the different Provincial Governments.

The Public Works and Immigration Act of 1870 provided a sum of £1,000,000, out of the loan then authorized, to be expended upon the introduction of immigrants throughout the colony.

The very liberal system under which immigration has been conducted, and which allowed residents in the colony to nominate suitable persons for free passages, was modified for a time owing

to the presence of a superabundance of labour, coupled with the fact that more than the average number of the most desirable class of immigrants—small farmers and others with means—were coming forward, and paying their own passages to the colony. Now, however, the system of nomination has been resumed, with the result, so far as at present seen, of the introduction of a very desirable class of people.

The immigrants who have arrived in New Zealand, taken as a whole, may be said to be of a superior order.

The following table shows the General Government expenditure on immigration to New Zealand during each year ending the 31st December, from the passing of "The Immigration and Public Works Act, 1870," to 1881, inclusive :—

Year.	Amount expended.	Year.	Amount expended.
1871 ...	... £17,081	1877 ...	... £140,828
1872 ...	... 37,911	1878 ...	... 102,190
1873 ...	... 142,646	1879 ...	... 176,630
1874 ...	... 426,233	1880 ...	... 72,259
1875 ...	... 447,578	1881 ...	... 5,539
1876 ...	... 323,708		

A further expenditure on immigration was incurred by the late Provincial Governments between 1871 and 1876, amounting to £74,409.

The following is a decennial return of immigration, 1872 to 1881 :

Year.	Immigration.			Emigration.			Excess of Immigration over Emigration.		
	Males.	Females.	Total.	Males.	Females.	Total.	Males.	Females.	Total.
1872	6,775	3,950	10,725	4,417	1,335	5,752	2,358	2,615	4,973
1873	7,871	5,701	13,572	3,507	1,254	4,761	4,364	4,447	8,811
1874	25,830	18,135	43,965	4,367	1,492	5,859	21,463	16,643	38,106
1875	19,558	12,179	31,737	4,727	1,740	6,467	14,831	10,439	25,270
1876	11,524	6,890	18,414	4,677	1,782	6,459	6,847	5,108	11,955
1877	8,104	1,883	12,987	4,696	1,915	6,611	3,408	2,968	6,376
1878	10,671	5,592	16,263	4,138	1,623	5,761	6,533	3,969	10,502
1879	15,186	8,771	23,957	3,852	1,382	5,234	11,334	7,389	18,723
1880	9,564	5,590	15,154	5,816	2,107	7,923	3,748	3,483	7,231
1881	6,643	3,045	9,688	5,705	2,367	8,072	938	678	1,616

Emigration.

Of the number of persons returned as having left the colony during 1881, amounting to 8,072, 669 went direct to the United Kingdom, and 6,777 to the Australian Colonies. There was, as regards the Australian Colonies and Tasmania, an excess of departures over arrivals to the extent of 1,198.

FINANCE.

Revenue.

The Customs revenue in 1881 amounted to £1,421,609, against £1,258,362 in 1880, being an increase of £163,247, or 12·97 per cent. The following figures show the comparative amounts realized by this branch of the revenue during the years 1866 to 1881, inclusive :—

	£		£	
1866 ...	844,267	being an increase of	114,259,	or 15·65 per cent.
1867 ...	843,997	„ a decrease of	270 „	·03 „
1868 ...	788,829	„ „ „	55,168 „	6·53 „
1869 ...	823,511	„ an increase of	34,682 „	4·39 „
1870 ...	765,930	„ a decrease of	57,581 „	6·99 „
1871 ...	731,883	„ „ „	34,047 „	4·44 „
1872 ...	813,279	„ an increase of	81,396 „	11·12 „
1873 ...	965,800	„ „ „	152,521 „	18·75 „
1874 ...	1,188,948	„ „ „	223,148 „	23·10 „
1875 ...	1,234,967	„ „ „	46,019 „	3·87 „
1876 ...	1,206,791	„ a decrease of	28,176 „	2·28 „
1877 ...	1,224,906	„ an increase of	18,115 „	1·50 „
1878 ...	1,344,688	„ „ „	119,782 „	8·90 „
1879 ...	1,237,259	„ a decrease of	107,429 „	7·98 „
1880 ...	1,258,362	„ an increase of	21,103 „	1·70 „
1881 ...	1,421,609	„ „ „	163,247 „	12·97 „

The total ordinary revenue for the colony in 1881 was as under:—

Ordinary revenue, raised by taxation	£3,206,554
Territorial revenue, not raised by taxation	550,939
Total revenue	£3,757,493

This shows an increase of £311,426 in the ordinary revenue, and £161,025 in the territorial revenue, as compared with 1880.

Expenditure.

The ordinary general expenditure, or expenditure chargeable on general revenue, for 1881, was £3,675,797, being a decrease on the similar expenditure in 1880 of £344,053. This does not include special expenditure out of loans.

Public Debt.

The total public debt of the colony on the 31st December, 1881, amounted to £29,659,111 ; the total annual charge upon which was £1,510,527, part of this sum, namely, £136,052, being a payment to the sinking fund. The amount to the accrued sinking fund, at the same date, was £2,203,893.

The estimated mean population for the year 1881 was 493,482. This is inclusive of 5,033 Chinese, but exclusive of 44,097 Maoris. The latter contribute largely to the revenue through the Customs, and many of them are wealthy. For the present purpose, therefore, they may very properly be included in the general total, which thus amounted to 537,579. These data give a total debt of £55 3s. 5d.

per head, and an annual charge of £2 16s. 2d. per head of population; but the amount of the accrued sinking fund, £2,203,893, in reality reduced the public debt to £27,455,218, and therefore the rate per head is proportionately lessened to £51 1s. 5d. per head. It has, however, been very justly remarked that the pressure of a public debt on a community is not to be estimated by the simple process of counting heads, but that it is to be more correctly ascertained by inquiry into the earnings and conditions of the population. Consideration must also be given to the fact that a large proportion of the debt of New Zealand exists in the form of reproductive works, already, in some instances, returning a fair interest on the outlay.

Accumulation.

Banks.

The total average liabilities of the banks within the colony during 1881 amounted to £10,083,188; the total assets to £14,863,645; the total paid-up capital on the 31st December, 1881, to £5,450,000; the total amount of last dividends to £365,500; and the total amount of reserve funds, at the time of declaring such dividends, to £2,681,259.

Savings-Banks.

The figures given below show the operations of the Post-Office Savings-Banks for the last three calendar years. The severe depression which existed throughout the colony during 1879 appears to have had comparatively little effect upon this business. A greater amount of money was withdrawn during the year, but the total amount left standing at the credit of depositors on the 31st December, 1879, was very little less than in 1878, and greater than in 1877; and since that time there has been a steady increase, as the following table shows:—

	1879.	1880.	1881.
Number of Post-Office Savings-Banks ...	165	178	190
Amount of deposits	£812,399	£864,441	£1,189,012
„ withdrawals	£876,180	£780,504	£902,195
„ at credit of depositors	£787,006	£903,765	£1,232,787
Average amount at credit of each depositor ...	£22 12s. 11d.	£23 7s. 6d.	£24 3s. 4d.

The average cost of each Post-Office Savings-Bank transaction, deposit or withdrawal, in the year 1881 was $4\frac{1}{2}\frac{3}{5}$d.; the average for the whole period of the existence of the Post-Office Savings-Banks in the colony being $7\frac{1}{2}\frac{1}{8}$d. The proportion of depositors to the population was 1 to 13 for 1878, while in 1881 it had risen to 1 in 10. The proportion in the United Kingdom, in 1877, was 1 in 19.

On the 31st December, 1881, the total sum standing at credit of

depositors in the Post-Office Savings-Banks amounted to £1,232,788
At the credit of depositors of other savings-banks ... £316,727

£1,549,515

This amount is equal to £3 1s. 10d. per head of the European population at the same date, as against £2 11s. 7d. for 1878.

These figures are valuable, as giving an indication of the prosperity of the working-classes; but there is a very large amount of savings constantly being invested in building societies, and as constantly being withdrawn for the purchase or erection of dwellings, of which no official record exists.

In No. VII. of the statistical diagrams at the end of this book will be found an interesting representation of the fluctuations in the rate of savings in New Zealand, in comparison with the rates of the Australian Colonies, during the years 1868–81, and with the average rate in Europe for the year 1877.

TRADE, INDUSTRIES, PRODUCTIONS, ETC.

Imports and Exports.

The following table exhibits the rapid growth of the import and export trade of New Zealand, from the date of the colony being established to 1881, inclusive:—

Period.	Imports.	Exports, the Produce of the Colony.
	£	£
1841–45, average for 4 years	139,000	33,000
1845–49 „ 5 „	193,000	77,000
1853–55 „ 3 „	766,000	330,000
1856–60 „ 5 „	1,188,000	438,000
1861–65 „ 5 „	5,352,000	2,718,000
1866–70 „ 5 „	5,168,000	4,335,000
1871–75 „ 5 „	6,367,000	5,276,000
1876–77 „ 2 „	6,939,000	5,783,000
1878	8,755,663	6,015,700
1879	8,374,585	5,743,126
1880	6,162,011	6,352,692
1881	7,457,045	6,060,866

The great bound exhibited in the above table, as taking place in the quinquennial period 1861–65, was caused by the gold discoveries. The first considerable export of this metal occurred in 1861, the value being £752,657, increasing in the following year to £1,591,389, and the year subsequent, 1863, to £2,431,723. A more than corresponding large increase in the imports took place in the same period, due

to the great influx of miners and immigrants from all parts of the world.

The total import and export trade of the colony for the year 1881, in proportion to population, amounted to £27 7s. 10½d. per head of the mean population (excluding Maoris), being an increase on 1880 of £1 0s. 2d. per head.

Diagrams V. and VI., in the statistical diagrams appended, exhibit a comparison between the import and export trade of New Zealand, the Australian Colonies, and the United Kingdom.

Trade with Different Countries.

A comparison of the total value of imports in 1880 and 1881, according to the countries whence they were received, gives the following results :—

United Kingdom,	increase	...	£1,051,099 or 30·2	per cent.
Australian Colonies	,,	...	22,359 ,, 1·1	,,
Other British Possessions	,,	...	88,249 ,, 19·6	,,
United States	,,	...	105,634 ,, 44·4	,,
Other countries	,,	...	27,693 ,, 42·2	,,

The following is a return, in detail, of imports and exports from and to different countries during the years 1880 and 1881 :—

RETURN of the VALUE of the IMPORTS and EXPORTS of the COLONY of NEW ZEALAND from and to each undermentioned COUNTRY, COLONY, or PORT, during the Years 1880 and 1881.

Country, Colony, or Port.	1881.		1880.	
	Imports therefrom.	Exports thereto.	Imports therefrom.	Exports thereto.
	£	£	£	£
United Kingdom	4,530,316	4,475,601	3,479,217	4,767,068
Australia :				
Queensland	5,201	3,464	7,168	4,892
New South Wales	606,338	375,236*	729,676	446,930*
Victoria	1,197,971	612,808*	1,036,588	825,263*
South Australia	22,532	43,022	47,063	43,369
Western Australia	2,000	...	5,469	47
Tasmania	118,725	2,759	104,494	4,729
Pacific Islands :				
Kermadec Island	...	6	...	...
Norfolk Island	2,720	3,725	431	3,755
New Caledonia	1,498	3,490	1,276	3,315
Chesterfield Island ...	210	...	...	...
Admiralty Island	465	102	...	...
Long Island	...	101	...	...
Cook Islands	19,059	13,033	19,952	14,634
Friendly Islands	5,056	13,769	9,446	11,978
Fiji Islands	21,193	19,474	27,124	28,397
Society Islands	10,705	6,124	...	4,216
Ellice Islands	...	63	...	449

* Including gold as follows: New South Wales, 1881, £190,024; 1880, £299,162. Victoria, 1881, £452,207; 1880, £693,823.

RETURN of the VALUE of the IMPORTS and EXPORTS, &c.—*continued.*

Country, Colony, or Port.	1881.		1880.	
	Imports therefrom.	Exports thereto.	Imports therefrom.	Exports thereto.
Pacific Islands—continued.	£	£	£	£
Gilbert Island	750	13	...	...
Kingsmill Islands	...	147	...	...
Navigator Islands	1,537	2,796	3,842	11,789
Suwarrow Island	...	1,112	...	120
Rotumah Island	2,311	454	4,790	1,289
Swain's Island	1,088	...	...	...
Union Islands	854	...	...	...
Marshall Islands	900	1,605	2,586	...
Mitchell Island	...	303	...	...
Sandwich Islands	19	7,146	365	1,371
Savage Island	2,799	708	4,623	78
Sunday Island	...	49	905	13
Malden Island	3,082	37	...	...
Howe Island	145	69	...	62
Macquarie Island	4,170	...	...	...
Wallis Island	...	...	...	1,308
Marquesas Islands	...	...	1,410	...
Manahiki Islands	...	...	1,314	28
Austral Island	...	...	...	1,165
Guam	...	9,460	...	6,300
Whale Fisheries	8,374	533	200	787
North America:				
Canada	...	...	100	...
Columbia	...	...	...	17
United States of America:				
On the Atlantic	302,138	116,629	201,095	95,188
On the Pacific	41,507	239,158*	36,916	9,959
China	149,228	11,098	115,188	24,710
Japan	95	...	...	...
Singapore	4,497	...	6,270	...
India:				
Bengal	115,774	...	103,517†	...
Madras	...	...	97	...
Bombay	10	...	23	48
Ceylon	262	...	200	...
Africa:				
Cape Colony	707	43,178	...	35,017
Natal	150	2,130	...	...
Mauritius	243,709	...	195,873	4,401
Europe:				
France	18,014	51,464	10,784	...
Spain	630	...	380	...
Portugal	2,404	...	894	...
Italy	...	...	60	...
Austria	20	...	...	...
Switzerland	5	...	...	...
Germany	5,779	...	1,434	...
Norway	4	...	23	...
Sweden	5	...	...	...
Holland	1,941	...	1,268	...
Belgium	26	...	...	...
Greece	122	...	...	...
Totals	7,457,045	6,060,866	6,162,011	6,352,266

* This includes gold to the value of £172,380. † Including Burmah.

It will be observed that the exports both to New South Wales and Victoria show a considerable decrease; but, if we eliminate the export of gold to those colonies, the return will stand thus:—

	Exports (not including gold). 1881.	1880.
To New South Wales ...	£185,212	£147,768
To Victoria	160,601	131,440

showing a satisfactory increase of £66,605; while, including the gold export, there is a falling-off of £284,149.

It must also be observed that gold to the value of £172,380 was in 1881 exported to the United States of America.

The following table shows the total quantity and value of the principal articles (the produce of the colony) exported in 1880 and 1881:—

Articles.	1880. Quantity.	1880. Value.	1881. Quantity.	1881. Value.
PASTORAL—		£		£
Wool	66,860,150 lb. ...	3,169,300	59,415,940 lb. ...	2,909,760
Tallow	101,470 cwt....	146,535	83,150 cwt....	120,611
Hides	20,839 ...	17,653	9,296 ...	9,194
Sheepskins	275,243 ...	32,598	332,789 ...	42,616
Rabbitskins	7,505,616 ...	66,976	8,514,685 ...	84,774
Leather	4,210 cwt....	26,097	13,600 cwt....	42,980
MINERAL—				
Gold	303,215 oz. ...	1,220,263	250,683 oz. ...	996,867
Silver	20,005 „ ..	4,500	18,885 „ ...	4,236
Coal	7,020 tons...	5,977	6,621 tons...	5,610
AGRICULTURAL—				
Flour	553¼ „ ...	6,008	3,220¼ „ ...	34,970
Bran and sharps ...	4,001¼ „ ...	15,596	3,465 „ ...	14,795
Wheat	3,120,463 bushels	632,943	3,761,258 bushels	745,739
Barley	476,520 „	84,783	494,911 „	79,881
Malt	35,330 „	11,609	60,531 „	17,883
Oats	1,908,132 „	169,662	1,499,260 „	142,569
Oatmeal	24,482 cwt....	13,455	12,511 cwt....	8,228
Potatoes	9,935 tons...	23,194	12,100¼ tons...	30,119
Butter	2,717¼ cwt....	8,350	2,426 cwt....	8,496
Cheese	717¼ „ ...	1,983	3,056¼ „ ...	6,112
Bacon and hams ...	67¼ „ ...	312	138 „ ...	536
Salt beef	1,530¾ „ ...	2,432	1,381 „ ...	2,370
Preserved meats ...	15,279¼ „ ...	38,563	9,595 „ ...	22,391
Grass seed	25,236 bushels	6,698	20,016 bushels	4,882
MISCELLANEOUS—				
Kauri gum	4,725 tons...	242,817	5,460¼ tons...	253,778
Phormium (N. Z. hemp)	894 „ ...	15,617	1,307¾ „ ...	26,285
Cordage	216¼ cwt....	438	277 cwt....	602
Timber (sawn) ...	7,611,576 feet ...	40,321	13,180,320 feet ...	65,119
„ (logs) ...	2,533 ...	10,820	1,709 ...	6,184
Fungus	3,832 cwt....	6,503	4,328 cwt....	9,735
Whale-oil	27,830 gallons	5,730	22,566 gallons	5,319
Sealskins	2,648 ...	3,179	1,259 ...	1,717
Soap	2,836½ cwt....	2,894	3,669 cwt....	3,534
Biscuits	3,741½ „ ...	4,454	3,018 „ ...	3,592

MINERAL EXPORTS from 1853 to 1881, inclusive.

Year.	Coal.		Copper.*		Iron.		Chrome Ore.		Silver.		Gold.	
	Amount.	Value.	Amount.	Value.	Amount.	Value.	Amount.	Value.	Amount.	Value.	Amount.	Value.
	Tons.	£	Tons.	£	Tons.	£	Tons.	£	Oz.	£	Oz.	£
1853	41	114	170	1,750	18	254	...	...	...	...	...	...
1854	...	...	302	3,450	9½	137	...	...	...	...	...	...
1855	94	266	140½	3,800	1½	20	...	...	...	...	...	...
1856	...	...	514	11,418	65½	520	...	...	...	...	...	...
1857	3	9	1½	70	...	...	...	...	...	...	10,297	39,904
1858	2	4	351¼	5,000	...	...	3	25	...	...	13,533	52,443
1859	...	...	245	2,605	...	...	8	120	...	...	7,396	28,427
1860	1	2	137	1,590	...	...	116	1,440	...	...	4,538	17,585
1861	...	...	110	1,300	...	...	52	520	...	...	194,234	752,657
1862	...	...	51	1,024	...	...	3,483	24,719	...	...	410,862	1,591,389
1863	...	...	...	...	...	...	595	4,318	...	...	628,646	2,432,479
1864	...	...	...	...	105	52	768	4,910	...	...	479,914	1,855,830
1865	...	...	...	...	...	...	...	...	...	...	574,574	2,252,689
1866	261	400	...	...	...	...	281	1,315	...	...	735,376	2,897,412
1867	973	1,228	246	2,700	...	...	...	...	...	...	688,753	2,724,276
1868	1,027	1,210	84	977	7	80	...	...	...	...	637,474	2,492,793
1869	756	800	7	179	1	3	...	...	11,063	2,993	614,281	2,362,995
1870	1,672	1,508	7	120	...	...	...	...	37,123	11,380	544,857	2,163,910
1871	1,695	1,612	...	...	...	...	...	...	80,272	23,145	730,023	2,788,368
1872	990	855	...	...	...	...	...	...	37,064	9,910	445,370	1,730,992
1873	724	655	...	...	...	...	...	...	36,187	9,850	505,337	1,987,125
1874	1,463	1,363	...	...	...	...	...	...	40,566	10,380	376,388	1,505,331
1875	3,385	3,129	...	...	...	...	...	...	29,085	7,560	355,322	1,407,769
1876	1,854	1,954	...	...	...	...	...	...	12,683	3,171	318,367	1,268,599
1877	2,658	2,071	...	...	...	...	...	...	33,893	7,556	366,955	1,476,312
1878	6,362	5,139	4	234	...	...	...	...	23,019	5,755	311,437	1,244,190
1879	7,144	6,187	...	...	...	...	...	...	20,645	4,512	284,100	1,134,641
1880	7,020	5,977	...	...	...	...	...	...	20,005	4,500	303,216	1,220,263
1881	6,621	5,610	...	...	...	...	...	...	18,885	4,236	250,683	996,867

VALUE of PRINCIPAL ARTICLES of EXPORT from 1869 to 1881.

Year.	Wool.	Gold.	Produce.	Tallow.	Kauri Gum.	Timber.
	£	£	£	£	£	£
1869	1,371,230	2,341,592	142,647	13,935	111,307	22,338
1870	1,703,944	2,163,910	184,513	75,583	175,074	18,509
1871	1,606,144	2,788,368	206,333	67,208	167,958	21,079
1872	2,537,919	1,730,992	371,887	68,788	154,167	26,718
1873	2,702,471	1,987,425	328,875	67,118	85,116	44,039
1874	2,834,695	1,505,331	432,924	65,366	79,986	44,450
1875	3,398,155	1,407,770	262,942	55,865	138,523	40,046
1876	3,395,816	1,268,599	399,374	109,896	109,234	49,847
1877	3,658,938	1,476,312	433,741	156,552	118,348	50,901
1878	3,292,807	1,244,192	528,109	178,502	132,975	39,074
1879	3,126,439	1,134,641	763,310	145,595	147,535	35,735
1880	3,169,300	1,220,263	1,009,260	146,535	242,817	51,225
1881	2,909,760	996,867	1,114,253	120,611	253,778	71,328

The very slight increase in the imports from the Australian Colonies is accounted for by a falling-off of £123,338 in the imports from New South Wales, and of £24,531 in the imports from South Australia. The imports from Victoria and Tasmania, however, show an increase of £161,433 and £14,231 respectively, which more than counterbalances the deficiency.

* Approximate return for period prior to 1853, 2,400 tons, £70,000.

Shipping.

The configuration of the colony, and the difficulty of traversing a country with few roads, early caused a considerable coastal traffic to be developed.

In December, 1881, there were 572 vessels on the New Zealand register, having an aggregate tonnage of 72,387 tons.

The total shipping inwards for 1882 was ... 461,285 tons.
" " outwards " " ... 438,551 "

Regular and frequent steam traffic exists between all the principal ports of the North and South Islands, and also between the colony and the Australian ports of Melbourne and Sydney. The ever-increasing requirements of the coastal and intercolonial traffic have been fully met, chiefly through the exertions and energetic enterprise of a local establishment, the Union Steamship Company of New Zealand. Almost daily communication is now maintained between the large centres of population in the South Island and the capital; and, by means of new and very powerful steamers belonging to the company, the passage between Wellington and Lyttelton, the connecting link, so to speak, between the railway systems of the two Islands, is practically reduced to a matter of some twelve or thirteen hours. This is a less time, by about four hours, than would be occupied by proceeding overland, supposing the present Canterbury line of railway continued to Picton, and a quick ferry established across Cook Strait between that port and Wellington.

There is also monthly communication with San Francisco by a subsidized line of mail steamers; the subsidy paid by the New Zealand Government in 1881 amounting to £32,500.

Direct Steam Service.

While this volume is in the press, a monthly service of steamers of large tonnage, to run between New Zealand and London, has been established by the New Zealand Shipping Company. The passage has been made in 43½ days.

A subsidy of £20,000 has been offered by the General Assembly for a direct monthly steam service under specified conditions, but at present has met with no response. Seeing, however, that steamers have already been started to run without subsidy, we may fairly conclude that direct connection between London and New Zealand by steamer is now established.

Manufactories, Works, etc.

Unstimulated by the questionable aid to be derived from so-called protective duties, the manufactories and industrial works of New Zea-

land yet exhibit unmistakable progress; their total number in 1881, as shown in detail in the census returns on a previous page, being 1,643, against 1,271 in 1878. This increase is almost entirely due to an extension in the number of industries dependent on the natural resources of the country, or incidental to a rapidly increasing population, and would seem to indicate a hardy and natural growth. Thus, since 1878 fellmongery, tanning, and currying establishments increased from 100 to 119; boiling-down and meat-preserving works, from 32 to 40; saw-mills, from 204 to 223; iron foundries, from 29 to 35; agricultural-implement factories, from 8 to 23; furniture factories, from 12 to 45; sail factories, from 1 to 13; bacon- and fish-curing factories, from 8 to 34. The increase in the number of woollen mills from 3 in 1878 to 4 in 1881 is small, but the increased quantity of goods manufactured is really much larger than the small increase in the number of establishments would appear to indicate, and from occupying an almost experimental position the woollen manufactures have grown into a sure and flourishing industry. This may be the better realized when it is stated that, while in 1878 the number of hands employed was 78, it had risen in 1881 to 417.

The number of manufactories devoted to articles of clothing increased from 7 in 1874 to 24 in 1878 and 54 in 1881.

CROWN LANDS.

The total area of New Zealand is upwards of sixty-four million acres. Of this, fourteen millions have been sold, or disposed of in education and other public reserves; sixteen millions belong to the aborigines, or to the Europeans who have purchased from them; and thirty-four million acres of Crown lands still remain for disposal. Of the latter, fifteen millions are open grass or fern country, ten millions forest, and nine millions are barren mountain-tops, lakes, and worthless country.

The Crown lands are administered under the authority of "The Land Act, 1877," "The Land Act 1877 Amendment Act, 1879," and "The Land Act 1877 Amendment Act, 1882," by the Hon. the Minister of Lands, Wellington. The colony is divided into eleven land districts, each being locally governed by a Commissioner and a Board. It is with the Land Offices the selector has to transact all business.

The names of the land districts will be found on page 111.

Crown lands are divided into three classes,—

(1.) Town and village lands—being the sites heretofore reserved or which shall be hereafter reserved for towns and villages:

(2.) Suburban land—being land in the vicinity of any town lands:
(3.) Rural land—being lands not reserved for towns or villages or other public purposes.

Acquirement of Freehold for Cash.

The manner of acquiring the freehold of Crown lands is either at auction or by application:—

1. *At Auction.*—The land is previously surveyed and marked off on the ground into sections. Maps showing the sections are on view at the Land Office, and particulars are advertised at least a month before auction. The land is sold to the highest bidder above the upset price, the terms being an immediate payment of one-fourth the purchase-money, and the remainder within one month.

2. *By Application or Free Selection.*—A form, filled in, and signed by the applicant or his agent, is left at the Land Office, for consideration of the Land Board. One-fourth of the purchase-money is paid on application, and the balance within one month after the applicant has been declared the purchaser. In Canterbury there is no deposit on application, but immediately on the Land Board approving of the application the whole of the purchase-money must be paid.

Price of Land.

Town and suburban lands are sold by auction. Town sections are usually one quarter-acre each, having a frontage of 66 feet to a street, and running back 165 feet. The minimum upset price is £7 10s. per quarter-acre section.

Suburban lands are sections of two to fifteen acres, and the minimum upset price is £3 per acre.

Village lands, in sections under one acre, are offered *on application* at not less than £5 per section; or, if situated in an inland district not opened up by railway, the price may be £2 10s. per section. If two or more persons apply on the same day for the same section, an auction is held confined to the applicants.

Village lands, in sections between one and fifty acres, are designated "small-farm allotments," and in the case of more than one applicant for the same section its occupancy is determined by lot. The price of small-farm allotments is not less than £1 per acre, or in a special district 10s. per acre. Small-farm allotments may also be had on lease, with or without a purchasing clause.

Rural lands comprise all other Crown lands, whether agricultural, pastoral, or forest. The price varies from the mere cost of survey, under the homestead system of Auckland and Westland, up to £2 per acre in Canterbury. The system of dealing with rural lands varies considerably in the different land districts.

Acquirement of Freehold on Deferred Payments.

The principal features of the deferred-payment system are—

(1.) If suburban land, an allotment must not exceed 20 acres; if rural agricultural land, 320 acres; if pastoral land, not less than 500 nor more than 5,000 acres.

(2.) No person may take up an allotment in more than one class; but any person who has for two years fulfilled all the conditions under which he took up his section can acquire further sections, provided he does not become the selector in the whole of more than 320 acres.

(3.) The price per acre of suburban land is £4 10s.; of rural land not less than £1; of pastoral land, upset price, not less than £1.

(4.) Suburban and rural lands are open for application, but if two or more persons apply for the same allotment it is auctioned between the applicants.

(5.) Land may, in place of being auctioned, be put up to public tender, and in the event of two or more tenders being of the same amount the successful tenderer is decided by lot.

(6.) Pastoral land is put up to auction at an upset price of not less than £1 per acre, and is open to all bidders.

The deferred payments are made in equal instalments in advance, every six months.

For suburban land the period for payment is five years; therefore there are ten instalments.

For rural land the period for payment is ten years, making twenty instalments: thus, if land offered at £1 per acre was applied for by A and B, and went to auction, and A closed the bids at £1 10s. per acre, he would have 1s. 6d. per acre to pay every six months for ten years.

For pastoral land the period of payment extends over fifteen years, with thirty instalments.

Any selector who has complied with the conditions of his purchase for three years may have the value of the unpaid instalments capitalized at the value of an annuity of the same amount and for the same period. Interest is payable at 5 per cent. per annum, instead of the half-yearly instalments. After the capitalized value is ascertained, he may pay off the whole sum, or any portion, in sums of not less than £10. At any time within fourteen years of the date of his license the selector is entitled to a Crown grant, if he has paid the whole of the capital value, together with interest.

On suburban land residence must begin within six months of

issue of license, and continue for four years; and on rural land the period of residence required is six years.

On pastoral land residence must begin within twelve months, and continue for six years.

Residence is not compulsory if the selector is residing on another deferred-payment section within three miles of his subsequent selection. Where land is wholly or mostly covered with bush, residence may be dispensed with altogether.

Improvement Conditions under the Deferred-Payment System.

Suburban.—Must bring into cultivation not less than a tenth of the allotment the first year, one-fifth the second year, and within four years must have three-fourths cultivated, the whole fenced, and have made substantial improvements to the value of at least £10 per acre.

Rural.—If open land, one-twentieth must be brought into cultivation the first year, one-tenth the second year, and within six years one-fifth must be cultivated and permanent improvements effected to the value of £1 per acre.

The purchaser of rural land may, at any time after the first three years, pay the balance of the purchase-money if he has effected the improvements. He is then entitled to the Crown grant of the land.

The term "substantial improvements of a permanent character" includes reclamation from swamps, clearing bush or scrub, cultivation, planting with trees or hedges, laying out gardens, fencing, draining, making roads, sinking wells or water-tanks, constructing water-races, in any way improving the character or fertility of the soil, or the erection of any building. This definition applies to all classes of land where improvements are required as part of the contract.

Pastoral.—No improvements are required. The only condition is residence for six years. The licensee may at the end of ten years from issue of license pay the balance of purchase-money, and so acquire the right to the Crown grant.

The Agricultural-Lease System.

This system is only in operation within proclaimed gold fields. It is similar to the deferred-payment system, inasmuch as the limit is 320 acres, and certain improvements have to be effected. But residence is optional. If after three years one-half the land has been improved, the purchase may be completed, or the lease may run on till the end of the seventh year. The yearly rent is at the rate of 2s. 6d. per acre, payable half-yearly, and the price at which the land may be bought during the currency of the lease is what may be fixed

by law as the upset price of land of the same class at the time the purchase is effected. After the third year also the holder may apply for an exchange lease: if this is granted, the payment of £1 1s. per acre, in fourteen half-yearly equal instalments, or the balance at any time in full, completes the purchase. Another way of completing the freehold is for the holder to pay rent for seventeen years, when the land is Crown-granted to him without any further payment.

Homestead System.

This is in force in the Auckland and Westland Districts only. The settler makes no payment for the land, the only cost being that of survey. On the fulfilment of conditions—viz., five years' residence, the erection of a house, and the cultivation of one-third of the selection if open land, and one-fifth if bush land—the Crown grant is issued. Any person of the age of eighteen years or upwards may (in Auckland District) select from 75 to 50 acres, according to quality of land, and any person under eighteen years of age 30 to 20 acres, provided that no family or household shall have more than 200 acres of first-class or 300 acres of second-class lands. In Westland the conditions are the same, with the exception that 50, 20, and 200 acres are the limits as above, irrespective of quality of land.

Pastoral Runs.

These are put up to auction, at an upset rent, not less than a year before the existing licenses or leases expire. Generally no more land than is sufficient to carry five thousand sheep or one thousand head of cattle is offered in one lot.

Pastoral lands are let, subject to the license being revoked on a year's notice being given that the land is required for sale or lease as agricultural or pastoral land. The licensee is not entitled to any compensation for revocation of his license. The licensee may select a homestead area of 150 acres, which cannot be resumed during the currency of his lease.

If a licensee does not reacquire the license for his run when it is submitted to auction, he is entitled to compensation for improvements of necessary buildings, plantations, fences, and ditches for draining, provided that the compensation does not exceed three times the average annual rent paid under the existing lease or license. No claim for compensation can be made against the Crown or any Land Board.

Leases or licenses of pastoral lands may not exceed twenty-one years. No person occupying, by himself or jointly, pastoral lands under license or lease from the Crown capable of carrying twenty

thousand sheep or four thousand head of cattle can be the purchaser or transferee of any other pastoral license or lease. This prohibition does not, however, affect transfers by way of mortgage, provided that in the event of possession being taken under any mortgage, or a mortgagee becoming an absolute owner in satisfaction of his mortgage debts, a *bonâ fide* sale of the land so acquired is effected within three years from the date of taking possession.

Leasing of Crown Lands with Perpetual Right of Renewal.

"The Land Act 1877 Amendment Act, 1882," gives authority to lease Crown lands, and secures to lessees the value of their improvements, and an indefeasible title, with perpetual right of renewal. The main features of the scheme are as follow:—

The Governor in Council may set apart for leasing one-third of the agricultural land open for sale.

Leases are sold to the highest tenderer at or above an upset rental of 5 per cent. on the capital value of the land as fixed by the Board. Thus, land valued at £1 per acre is put up at a rental of 1s. per acre per annum. Six months' rent, together with £1 10s. for the lease, has to be deposited with every tender. If two or more tenderers offer the same rent, and there is no higher offer, it is decided by lot which person shall be the lessee.

If a lease is not executed within a certain time the deposits are forfeited, and the next highest tenderer may be declared the lessee. If no tenders are received any person may apply to lease the land for which tenders have been invited. Any person may tender for two or more leases, but cannot become the lessee under more than one lease, unless the lands adjoin each other. A tenderer for more than one lease need only deposit half a year's rent of the tender largest in amount. Any person of the age of eighteen years may become a lessee.

Limit of Area for each Lessee.

No person who owns the freehold of or who holds a license or lease from the Crown of land which, together with the lands included in any lease applied for, comprises more than 640 acres, is capable of becoming a lessee. This does not apply to persons who may become lessees or sub-lessees by marriage, or under a will, or by an intestacy.

As to Preparation, Cost, Execution, and Registration of Leases.

Leases are prepared by the Commissioners of Crown Lands, are registered under the Land Transfer Acts, and are exempted from stamp duty.

Provisions as to Term, Payment of Rent and Taxes.

Every lease is for a fixed term of thirty years. All leases are renewable. All rents are payable in equal half-yearly instalments, in advance. Lessees are liable for all rates, taxes, or assessments.

Provisions as to Transfers, Sub-Leases, and Sales by Mortgage.

Leases may be transferred or sub-let, but the limits as to area of land owned or occupied have to be complied with by the new holder.

Surrenders of leases are permitted with the consent of the Land Board.

Leased lands may be resumed for public purposes on payment of compensation to be fixed by arbitration, a proportional abatement of rent being allowed.

Provisions as to Residence.

Every lessee must reside upon his land within six months of the commencement of his term, and continue to reside for six years. The Board may, however, in the case of bush lands, dispense with residence until two years, or, in the case of youths living with their parents or relatives, until three years after the commencement of the term; or may dispense with residence altogether if the lessee resides on land contiguous to his lease. This does not apply to leases acquired under an intestacy or by will. In case two lessees intermarry one may be absolved from the residential condition.

Improvement Conditions.

Each lessee must within one year from the date of his lease bring into cultivation not less than one-twentieth, within two years not less than one-tenth, within four years not less than one-fifth, of his leasehold; and within six years, in addition to the cultivation of one-fifth of the land, he must put on it substantial improvements to the value of £1 for every acre.

The definition of "substantial improvements" will be found at page 106.

Right to acquire Freehold.

Any lessee of land outside a proclaimed gold field has the right of purchase (if within the six years he has fulfilled all the improvement conditions (at a price fixed when the lease is granted, but not less than the estimated value on which he has paid rent at 5 per cent. Advantage must, however, be taken of the purchasing right within eleven years of the commencement of a lease.

Provisions as to Renewals.

Three years before the end of the term of a lease a valuation of

the land and all substantial improvements is made by arbitration. After the award of the arbitrators, and at least three months before the expiry of the lease, the lessee chooses whether he will accept a fresh lease for twenty-one years at a rental of 5 per cent. on the gross value, as fixed by the arbitration, *after deducting the value of the substantial improvements of a permanent character.*

If the lessee does not accept a renewal of his lease, a new valuation of the improvements is made, and the lease is submitted to public tender for twenty-one years at an upset rent not greater than the rent at which the lease was originally offered. If any other person than the lessee is declared the purchaser, he has to pay to the original lessee the value of the improvements.

In the event of a lease not being sold, the existing lessee may continue in occupation from year to year, so long as he pays the rent and fulfils the covenants of his lease, until a new lessee takes up the lease. At any time during his temporary occupation the existing lessee can obtain a renewed lease for a further period of twenty-one years on the terms first offered. An existing lessee gets a month's notice of intention to sell the lease of the land he occupies, and is allowed during that time to elect to accept a new lease on the terms first offered. All the provisions relating to original leases apply to renewed leases, the only difference being that renewed leases are for twenty-one instead of thirty years.

Statistics.

Crown Lands sold, and Revenue, during Year ending 31st March, 1882.

The total area of Crown lands sold during the year ending on the 31st March, 1882, was as under:—

On Immediate Payments.

	Acres.		Purchasers.	Cash received.	Scrip.
Town lands	303	to	704		
Suburban lands ...	1,482	„	271	£284,199	£2,840
Rural lands	195,390	„	1,257		

On Deferred Payments.

	Acres.		Purchasers.	Cash received.
Agricultural	74,336	sold to	497	
Pastoral	24,624	„	9	£55,428
Village settlement ...	1,189	„	198	

There was also received for agricultural leases on gold fields £7,600; for pastoral rents, £182,880; and from royalties, &c., £5,500: making a total revenue of £535,607.

Total Land sold or otherwise disposed of.

The total area of Crown land sold or otherwise disposed of, from the first return in 1856 to the 31st March, 1882, amounted to

16,833,371 acres, of which 12,265,187 acres were sold for cash, realizing the sum of £11,958,164.

Remaining on hand.

The following tabular statement shows the area of Crown land remaining on hand on the 31st March, 1882. This does not include land for the acquisition of which the Government is negotiating with the Natives, or the large area of land in permanent possession of the Natives; nor does it include the large reserves made for various public purposes :—

Land District.	Open for Selection 31st March, 1882.	Remaining at Disposal of Land Boards, exclusive of Native Lands.	Total.
NORTH ISLAND.	Acres.	Acres.	Acres.
Auckland	52,111	3,037,760	
Hawke's Bay	38,065	208,320	
Taranaki	11,029	568,217	
Wellington	54,968	1,216,264	
West Coast	1,677	241,169	
	157,850	5,271,730	5,429,580
SOUTH ISLAND.			
Nelson	5,840,811	...	
Marlborough	550,500	1,067,722	
Canterbury	4,390,359	800,000	
Westland...	254,951	2,668,328	
Otago	230,000	10,183,111	
Southland	1,506,631	...	
	12,773,252	14,719,161	27,492,413

The total number of acres of Crown lands held for depasturing purposes on the 31st March, 1882, was 12,028,966 acres, in the hands of 1,020 holders, the rents and assessments of which amounted to £182,880.

LAND TRANSFER.

The Land Transfer Act, modelled upon the famous system introduced by Sir Robert Torrens in South Australia, has now been in operation in New Zealand for some years, and the simple and inexpensive means which it offers for dealing with landed property and mortgages have been freely and extensively taken advantage of, as is indicated by the figures in the following returns :—

RETURN FOR THE YEAR ENDING 31ST MARCH, 1882.

—	Extent.	Number.	Value.
	Acres.		£
Applications for registration	...	1,201	1,264,848
Transfers	...	7,715	2,814,446
Crown grants—			
Town and suburban	4,326	2,108	...
Country	393,912		
Mortgages	...	5,883	6,151,795

The fees paid to the Government on the above-mentioned transactions amounted to £28,242, being £23,587 for general fees and £4,655 for land assurance, equivalent to an average of £1 13s. 5d. on each transaction.

Titles guaranteed.

The sum of £4,655 for land assurance represents a charge of one halfpenny in the pound on the value of land brought under the operation of the Act, in consideration of which the Government guarantees the titles. No claim, however, has yet arisen upon the assurance fund thus formed. The balance to credit of this fund on the 31st March, 1882, was £33,826.

Mortgages.

The following return shows the mortgage transactions under the Land Transfer Act for the year ending the 31st March, 1882 :—

District.	Total Amount secured by Mortgage under the Land Transfer Acts during the Year ending 31st March, 1882.	Total Amount of Mortgages paid off during same Period.	Total Amount remaining secured by Mortgage under the Land Transfer Acts, 31st March, 1882.
	£	£	£
Auckland ...	714,536	186,990	1,602,666
Otago	817,996	475,995	4,239,080
Canterbury ...	2,948,745	1,033,936	7,549,772
Wellington ...	520,114	313,541	1,938,713
Nelson	74,723	37,414	276,239
Southland ...	706,495	307,658	2,207,581
Hawke's Bay ...	244,928	178,476	1,167,988
Westland ...	7,016	13,290	68,075
Taranaki ...	88,889	40,496	207,346
Marlborough ...	28,353	8,295	136,067
Totals ...	6,151,795	2,596,091	19,393,527
Year ending 31st March, 1881	6,727,898	2,402,207	15,837,823

PUBLIC WORKS.

Any account of New Zealand's progress that failed to make special mention of the extraordinary changes wrought by what is commonly known as the "Immigration and Public Works policy" would indeed be incomplete.

The rugged character of the country generally, and the natural difficulties appertaining to many of the sites upon which the chief towns were built, very early necessitated a large outlay on roads and public works. The necessity was fully recognized, and to some extent met, by most of the Provincial Governments, who have justly received great credit for their far-seeing and liberal exertions in that direction. A great deal of road-making, often of a very costly character, was accomplished, harbour and other improvements begun, and immigration handsomely encouraged. Something was also done in the way of the making of railways, notably in Canterbury, where a line unusually difficult and expensive in construction, involving some heavy tunnelling, was successfully undertaken and carried through by the Provincial Government, in order to provide easy means of communication between Christchurch and the Port of Lyttelton. Some advance towards the construction of a main trunk line had also been made in the same province. In Otago, also, the City of Dunedin had been connected with Port Chalmers by a railway, constructed under the guarantee of the Otago Provincial Government, and some miles of railway had been made in Southland. But the work to be done in the colony generally was too vast to be grappled with by the separate exertions of a few local Governments. It was therefore proposed that the General Government should take in hand the execution of all public works of a colonial character, upon an extensive and well-defined system, and that a loan of ten millions be raised to provide funds for that purpose. The objects sought to be accomplished were defined to be,—

I. Systematic immigration on a large scale.
II. Construction of a main trunk railway throughout each Island.
III. Construction of roads through the interior of the North Island.
IV. The purchase of Native land in the North Island.
V. The supply of water on gold fields.
VI. The extension of telegraph works.

In accordance with the plan thus laid down, "The Immigration and Public Works Act, 1870," was passed by the Legislature, and many

who were greatly alarmed when the scheme was first propounded to the country by Mr. (now Sir Julius) Vogel, and thought it wild and extravagant, have since admitted that the step taken was as wise as it was bold. A considerable extent of country has been opened up and settled by a large and thriving population in a surprisingly short space of time. As facilities were offered for the conveyance of the products of agriculture, the value of land, of course, greatly increased: not its nominal value merely, but its actual value. Hundreds of thousands of acres, worth, before the advent of railways, from £1 to £3 an acre, were afterwards sold at prices ranging from £10 to £20 per acre, and, for the most part, bought by experienced farmers, who had made their money in the colony, and knew the real capability and value of the land so purchased. It may also be said that, in addition to the enormous reproductive indirect results of the Public Works policy, the outlay incurred, at least in the case of the railways constructed, is likely to prove a capital investment, and so be directly reproductive, many of the principal lines already yielding a fair interest on the money expended in their construction.

The total amount expended on public works by the General Government, from the date of the Immigration and Public Works Act of 1870, and similar subsequent Acts, and under their authority, up to the 31st March, 1882, is as under:—

Railways	£9,869,670
Roads and Road Boards	1,353,800
Coal mines	10,835
Water supply on gold fields ...	460,779
Works on Thames Gold Field ...	50,000
Telegraphs	420,032
Public buildings	986,105
Lighthouses and harbours	109,045
Miscellaneous works	557,278
Departmental	170,576
	£13,988,120

Roads and Bridges.

A great deal of road-making has been done in New Zealand.

The district roads are undertaken by the various Road Boards. The total number of these Boards in 1882 was 321, and their expenditure in the same year amounted to a total of £244,381, the whole being expended on actual works, less the sum of £27,504 for expenses of administration.

Much road-making has also been done by the General Government, especially in the North Island. During the period extending from June, 1869, to March, 1882, the General Government expenditure in this department amounted to the sum of £1,324,887, the roads constructed being over 3,000 miles. To this must be added £225,000 paid to Road Boards previous to the 31st March, 1881, and a considerable amount included in the returns under the head of "Miscellaneous Public Works." During the year ending on the 31st March, 1882, the expenditure by the General Government under this head was £69,871 in the North Island, and £28,896 in the South Island.

Railways.

Soon after the passing of the Immigration and Public Works Act in 1870, the construction of railways on a large and systematic scale was commenced, and has proceeded vigorously since that time. The total length of lines open for traffic on the 31st March, 1882, was 1,334 miles; and there were under construction 188 miles.

The total amount of money expended in the construction of railways up to the 31st March, 1882, was £10,974,000; but the cost of lines open for traffic at the same date was £9,443,000.

The following table gives a view of the progress made in railway construction between the years 1876 and 1882, and the annual revenue and expenditure:—

Year ending	Revenue.	Expenditure.	Expenditure per cent. of Revenue.	Number of Miles.	
				Constructed.	Under Construction.
	£	£			
30th June, 1877	469,051	337,445	71·94	860	304
„ 1878	569,898	405,896	71·22	1,053	163
„ 1879	758,096	545,479	71·95	1,140	204
31st March, 1880*	762,573	580,016	76·06	1,181	257
„ 1881	836,077	521,958	62·43	1,288	192
„ 1882	892,026	523,099	58·64	1,334	188

Diagram No. VIII. exhibits the comparative progress made in railway construction by New Zealand and Australian Colonies during the years 1868–82.

It will be seen that the cost of working the railways for the twelve months ending on the 31st March, 1882, was very much less than in previous years, for the revenue for that period exceeded the expenditure by £368,927, the ratio of the expenditure to the revenue

* Owing to the change in the financial year this statement overlaps the previous year, for purposes of comparison.

being only 58·64 per cent. The receipts per mile for the same period averaged £668 13s. 8d., and the expenditure £392 2s. 7d. The railways which are open for traffic thus made a return on the capital spent in their construction of £3 18s. 2d. per cent., which may be taken as a favourable result, for it may reasonably be expected that, when the many links in the chain of railways contemplated for the North Island are completed, some of the North Island lines will give a better result than they do at present.

POST AND TELEGRAPH DEPARTMENT.

The difficulty of communication, naturally incidental to a newly settled country like New Zealand, has been well met and mastered by an energetic and able postal organization, aided also by a very efficient telegraph system. In both services the policy has been to charge low rates, so as to give the public the greatest facilities for intercommunication.

The following figures, taken from the last report of the Postmaster-General and Commissioner of Telegraphs, will afford an indication of the extent to which these advantages have been made use of by the people.

The total revenue of the Department for the year was £234,529, showing an increase of £11,937 on the previous year. Taking into account the sum of £58,585 for official postage, and £22,738 for official telegrams, the gross earnings of the department for the year amounted to no less than £82,560 in excess of the expenditure.

Postal Business.

The total number of letters, newspapers, post-cards, and book packets received during the year 1881, for delivery in New Zealand, may be seen in the following table:—

Where from.	Letters.	Newspapers.	Post-cards.	Book Packets.
United Kingdom	547,219	1,464,781	...	234,737
Australian Colonies	341,956	508,408	...	45,259
ther places	48,166	77,248	...	17,867
From places within the colony ...	11,969,191	5,019,380	490,366	921,944
Totals	12,906,532	7,069,817	490,366	1,219,807

Compared with the returns of the previous year, letters increased 11·97 per cent., post-cards 45·69, book packets 11·27, and newspapers 19·23. This shows a considerable increase on the work of the pre-

vious year; and the work of the department, compared with former years, continues to advance in a proportion greater than the increase of population would seem to warrant, showing that the facilities for communication between the different parts of the colony are being annually improved.

The average number of letters posted in proportion to the estimated population was 23·89 to each person, the average in 1877 being 14·51. The increase of post-cards, since their introduction in 1877, is very marked.

There were 868 post-offices open on the 31st December, 1881.

In the transaction of money-order business, 13,556 orders were issued during the year for £452,182. The money orders issued in New Zealand for payment in the United Kingdom, Germany, and the Australian Colonies were 36,033 in number for £130,547, and 8,115 orders for £32,942 were issued in the United Kingdom and Australia for payment in New Zealand. There was accordingly a balance of £97,605 remitted out of the colony by means of money orders.

The telegraph was used during the year for the transmission of 14,241 orders, amounting to £55,516.

Postal communication with the United Kingdom is principally by way of San Francisco. The service is four-weekly, and the average number of days within which the mails were delivered from London during the year was—to Auckland, 39·36 days; to Wellington, 41·57; and to Dunedin, 42·93 days.

A considerable amount of correspondence also goes by way of Melbourne and Point de Galle. This route, however, takes longer than the San Francisco service.

Postage Rates.

The charge for postage of letters is, within towns, one penny per half-ounce or fraction thereof, and double that rate for delivery in any part of the colony or in any part of Australia. Penny stamped post-cards are also issued deliverable anywhere in New Zealand. The postage for book packets is at the rate of one penny for every two ounces, and the same scale applies to parcels coming within the category of the pattern and sample post. The limit of weight allowed for the inland pattern, sample, and book post is five pounds; and a packet must not exceed two feet in length, or one foot in width or depth. The postage rate on newspapers is one halfpenny within the colony, and double that sum for delivery in Australia and England. *Bonâ fide* magazines are charged one halfpenny for two ounces.

Telegraph System.

The telegraph system is entirely in the hands of the Government. The difficulties to be overcome before telegraphic communication was generally established were of an unusual character, the country being to a large extent rugged and wild, while the Islands being divided by Cook Strait rendered it necessary to undertake the laying of a telegraph cable to connect them. The work, however, was pushed forward with great vigour. By July, 1873, 2,356 miles of line had been completed, carrying 4,574 miles of wire, at a cost (inclusive of the submarine cable) of £224,580. The number of miles of line now open is 3,824; of wire, 9,653.

Telegraph Business.

The following figures show the telegraph business done during the years ending on the 31st March, 1881, and 31st March, 1882:—

	1881.	1882.
Number of messages ...	1,304,712	1,438,772
Cash received	£73,002	£78,829
Value of Government messages	£27,021	£22,738

According to the report of the Postmaster-General, the receipts of the telegraph branch of the department for the financial year ending on the 31st March, 1882, including credit taken for the value of Government messages, show a balance over working expenses of £14,109.

Telegraph Charges.

The large telegraph business indicated by the foregoing figures is doubtless due, in no small degree, to the introduction of a uniform and low scale of charges. For the first four years a mileage rate was charged of from 2d. to 6d. per word. In 1869 this was altered to a uniform rate of 2s. 6d. for the first ten words, and 6d. for every additional five words. In 1870 the charge was reduced to 1s. for the first ten words, and 6d. for each additional five words; and in 1873 the charge was yet further reduced, any additional words over the first ten being rated at one penny for each word. More recently a still further reduction has been made for a certain class of messages called by the somewhat awkward term of "delayed telegrams."

GOVERNMENT LIFE ASSURANCE.

An Act was passed in 1869 empowering the Government to grant life assurances and annuities on the security of the colonial revenue

and the business was actually commenced in March, 1870. As may be seen by the statement below, from very small beginnings the business steadily increased; the total number of policies issued up to the 30th June, 1882, being 19,456, representing an aggregate insurance amounting to £6,507,528, while the amount of the funds at the same date was £653,890.

It may be useful in this manual to notice the principal advantages offered to policy-holders by the Government Insurance Department of New Zealand, which is the first British colony that has, by special legislation and exceptional attractions, stimulated the growth of those self-dependent and provident habits that lie at the root of the life-assurance system. These advantages may be briefly stated as follows:—

1. The inviolable security offered to the assured, the payment of every policy being guaranteed by the colony under a special Act of Parliament.

2. The division of profits, the whole of which are by law to be divided amongst policy-holders only, who thereby enjoy the advantages possessed by members of mutual companies, in addition to that of having the security of the colony for the payment of claims. The first quinquennial investigation showed a profit of over £12,000; and the investigation which took place on the 30th June, 1880, showed the surplus funds to amount to £77,595. Out of this sum, £56,000 was divided amongst policy-holders.

3. The low scale of premiums comes next in order. The premiums are as low as the non-participating rates in other offices, and yet they entitle policy-holders to a full share of the profits that may accrue.

4. The regulations affecting policy-holders are liberal, and compare favourably with those of other institutions. Thus policies contain no restrictive conditions as to voyaging, trade, or occupation. A policy-holder may travel in any part of the world, or engage in any occupation. Admission of age is indorsed on policies when issued, if a certificate of birth or the best evidence available is produced. Policies are kept in force as long as the surrender value is sufficient to pay the premium in arrear and interest, and may be revived within twelve months after the surrender value is exhausted, on proof of unimpaired health and payment of arrears. Policy-holders can borrow 90 per cent. of the surrender value of their policies. Policies are indisputable and unchallengeable after five years' duration, if age has been admitted.

The subjoined tabular statement will show the remarkable growth of the business of this department:—

COMPARATIVE RETURN OF POLICIES ISSUED.

Year ending 30th June,	Number of Policies.	Sum Assured.
		£
1870	53	27,800
1871	409	178,674
1872	1,355	456,225
1873	1,161	429,450
1874	1,499	506,910
1875	1,450	498,715
1876	1,485	504,509
1877	1,409	563,928
1878	1,991	680,600
1879	2,057	682,200
1880	2,274	725,254
1881	1,790	550,351
1882	2,523	702,912
	19,456	£6,507,528

EDUCATION.

STATE SCHOOLS, PRIVATE SCHOOLS.

The total number of common schools receiving Government aid and under the control of Education Boards was, in December, 1881, 869 (against 836 in 1880), having a total of 2,087 teachers, and with the names of 83,560 pupils on the books; the daily average attendance numbering 64,744. There were also at the principal centres of population superior schools, most of which have been endowed, directly or indirectly, with lands and money out of the public estate. The number of private schools in December, 1881 (from which returns were received), was 266, the number of teachers being 590, and pupils 9,987.

The public schools are free, and the instruction imparted in them is secular, because the cost is defrayed by an annual parliamentary vote. For 1881 the expenditure was £324,268, of which £58,254 was for buildings. The average expenditure for each scholar in attendance was £4 1s. 6d., of which 18s. 3¼d. has been for buildings. Some of the endowed secondary schools, and the three endowed collegiate institutions in Otago, Canterbury, and Auckland, are affiliated to the New Zealand University, which is an examining body, having power to confer degrees and to grant scholarships, and is maintained by an annual grant from the consolidated revenue.

NATIVE SCHOOLS.

The number of schools at the end of 1881 for the education of the Maori race was 68. The number of pupils amounted to 2,010, an increase, as compared with the previous year, of nearly 400. The

average attendance during the year was 1,562. The number of instructors was 112. The cost of the education of Native children (excluding those who attend the public schools) was, for the year 1881, £18,699.

Many European schools also received subsidies from the Government for the support of Maori pupils: 632 Maoris—viz., 349 boys and 283 girls—attended these schools, an increase on the previous year of 111 boys and 86 girls. Thus the total number of Maori children receiving education in 1881 amounted to 2,642.

CONSTABULARY, VOLUNTEERS, FIRE BRIGADES.

Constabulary.

The total strength of the Armed Constabulary on the 31st March, 1882, amounted to 1,404 men of all ranks. Of this number, 447—viz., 11 officers, 75 non-commissioned officers, and 361 constables—were engaged in the police duty of the colony; while the reserves, consisting of 21 officers, 81 non-commissioned officers, and 855 constables, were performing duties of a military character.

Volunteers.

The various branches of the Volunteer Force on the 31st December, 1881, had a total strength of 10,294 officers and men including 1,783 cadets, belonging to 144 corps. The totals of each branch of the service were as follow:—

	Corps.	Strength.
Cavalry	9 ...	820
Artillery	13 ...	989
Engineers	3 ...	253
Rifles	79 ...	5,300
Naval	8 ...	956
Cadets	32 ...	1,976

In October, 1881, when it was decided to advance against Te Whiti at Parihaka, the Districts of Auckland, Nelson, Marlborough, Wellington, and Canterbury were called upon for volunteers for active service, and readily afforded a contingent of 64 officers and 1,048 men, while hundreds were anxious to go whose services were not accepted. The campaign was, however, only demonstrative, as the Maoris suffered themselves to be taken into custody without offering resistance; but the officer commanding the forces recorded his high appreciation of the exemplary and soldierlike manner in which the whole force behaved under the circumstances.

Fire Brigades.

In 1881 there were 38 fire brigades in the colony, having a total strength of 148 officers and 811 men.

APPENDIX.

DESCRIPTIVE LIST OF THE PRINCIPAL FOREST TREES OF NEW ZEALAND.

Order—CONIFERÆ.

Genus—*Dammara*, L'Héritier.

Dammara australis, Lambert.

Kauri.—The kauri is the finest forest tree in New Zealand, and attains a height of 120–160 feet. The trunk is sometimes 80–100 feet high before branching, and attains a diameter at the base of 10–20 feet.

The timber is in high repute for masts and spars, deck and other planking of vessels, and is largely used for house finishings. There is abundant evidence of its durability for more than fifty years in some of the old mission-buildings at the Bay of Islands. The buried logs of an ancient kauri forest near Papakura have been excavated and found to be in perfectly sound condition, and were used for sleepers on the Auckland and Waikato Railway. On the Thames gold field kauri is used for mine props, struts, and cap-pieces. It forms the bulk of the timber exported from New Zealand.

Some of the largest and soundest kauri timber has richly mottled shading, which appears to be an abnormal growth, due to the bark being entangled in the ligneous growth, causing shaded parts, broad and narrow, according as the timber is cut relative to their planes. This makes a rich and valuable furniture wood, and in the market is known as "mottled kauri."

The kauri pine occurs only in the North Island and north of Mercury Bay, and grows best near the sea on wet clay land. The kauri forests are largely composed of other trees as well as their characteristic tree.

The turpentine of this tree forms the celebrated kauri gum, which is extensively excavated from the sites of old forests as far south as Taranaki. In 1871 there were exported 5,053 tons, valued at £167,958; in 1875, 2,230 tons, valued at £138,528; in 1877, 3,632 tons, valued at £118,348; and in 1882, 5,533 tons, valued at £260,369.

Genus—*Libocedrus*, Endl.

Libocedrus doniana, Endl.

Kawaka, Cypress, Cedar.—This handsome tree attains a height of 60–100 feet, and a diameter of 3–5 feet. Wood reddish, fine-grained

and heavy; used by the Maoris for carving, and said to be excellent for planks and spars; grows in the North Island, being abundant in the forests near the Bay of Islands and to the north of Auckland.

Libocedrus bidwillii, Hook.

Pahautea, Cedar.—A handsome conical tree 60–80 feet high, 2–3 feet in diameter. In Otago, it produces a dark-red free-working timber, rather brittle, chiefly adapted for inside work. Found on the central ranges of the North Island, and common throughout the forests of the South Island, growing at altitudes of 500 to 4,000 feet. This timber has been used for sleepers on the Otago railways of late years, is largely employed in that district for fencing purposes, and is frequently mistaken for totara. In former years it was believed to be suitable only for inside work.

Genus—*Podocarpus,* L'Héritier.

Podocarpus ferruginea, Don.

Miro, Bastard Black-pine of Otago.—A large ornamental and useful timber tree; attains a height of 40–60 feet, trunk 2–3 feet in diameter. A useful wood, but not so durable as the matai or true black-pine wood; reddish, close-grained and brittle; the cross section of the timber shows the heartwood star-shaped and irregular. The timber is generally thought to be unfitted for piles and marine works, except when only partially exposed to the influence of sea-water as shown in the railway embankment at Bluff Harbour, where it is reported to have been durable. Grows in the North and South Islands at altitudes below 1,000 feet.

Podocarpus totara, A. Cunn.

Totara.—A lofty and spreading tree, 60–120 feet high, 4–10 feet in diameter. Wood very durable and clean-grained, in appearance like cedar, and works with equal freedom; it is adapted for every kind of carpenters' work. It is used extensively in Wellington for house-building and piles of marine wharves and bridges, and railway sleepers, and is one of the most valuable timbers known. The wood, if felled during the growing season, resists for a long time the attacks of teredo worms. It splits freely, and is durable as fencing and shingles. Totara post-and-rail fences are expected to last from forty to fifty years. The Maoris made their largest canoes from this tree, and the palisading of their pas consisted almost entirely of this wood. Grows throughout the North and South Islands upon both flat and hilly ground; the timber from trees grown on hills is found to be the most durable.

Podocarpus spicata, Br.

Matai, Mai, Black-pine of Otago.—A large tree, 80 feet high; trunk 2–4 feet in diameter. Wood yellowish, close-grained and durable; used for a variety of purposes—piles for bridges, wharves, and jetties, bed-plates for machinery, millwrights' work, flooring, house-blocks, railway-sleepers, and fencing. Bridges in various parts of the colony afford proof of its durability. Mr. Buchanan has described a log of matai that he found had been exposed for at least two hundred years in a dense damp bush in North-East Valley, Dunedin, as proved by its being enfolded by the roots of three large trees of *Griselinia littoralis,* 3 feet 6 inches in diameter, with over 300 growth rings. Grows in both North and South Islands at altitudes under 1,500 feet.

Podocarpus dacrydioides, A. Rich.

Kahikatea, White-pine.—A very fine tree, 100–150 feet high; trunk 4 feet in diameter. Timber white and tough, soft, and well adapted for indoor work, but will not bear exposure. Abundant throughout the North and South Islands. When grown on dry soil it is good for the planks of small boats, but when from swamps it is almost useless. A variety of this tree, known as yellow-pine, is largely sawn in Nelson, and considered to be a durable building timber.

Genus—*Dacrydium.*

Dacrydium cupressinum, Soland.

Rimu, Red-pine.—Tree pyramidal, with weeping branches when young; trunk 80–130 feet high, and 2–6 feet in diameter. An ornamental and useful timber; wood red, clear-grained, heavy, and solid; much used for joisting and planking, and general building purposes, from Wellington southward. Its chief drawback is in being liable to decay under the influence of wet. It is largely used in the manufacture of furniture, the old wood being handsomely marked like rosewood, but of a lighter brown hue. The juice of this pine is agreeable to drink, and was manufactured into spruce beer by Captain Cook. Grows throughout the North and South Islands, but is of best quality in the central district.

Dacrydium colensoi, Hook.

Manoao, Yellow-pine.—A very ornamental tree, 20–80 feet high. Wood light yellow. It is the most durable and strongest timber in New Zealand. Posts of this wood have been in use among the Maoris for several hundred years. Grows in the North and South Islands up to 4,000 feet altitude. This tree is curious from having

two kinds of leaves on the same branches. It is greatly valued for furniture.

Genus—*Phyllocladus.*

Phyllocladus trichomanoides, Don.

Tanekaha, Celery-leaved Pine.—A slender, handsome tree, 60 feet high; trunk rarely exceeds 3 feet in diameter; wood pale, close-grained, and excellent for planks and spars; resists decay in moist positions in a remarkable manner. Grows in the North Island, especially in the hilly districts.

Phyllocladus alpinus, Hook.

Toatoa.—A small ornamental and densely-branched tree, sometimes 2 feet in diameter. Bark used for dyeing and making tar. Found in both North and South Islands.

Order—CUPULIFERÆ.

Genus—*Fagus,* Linn.

Fagus menziesii, Hook.

Tawhai, Red-birch (from the colour of the bark).—A handsome tree, 80–100 feet high; trunk 2–3 feet in diameter. The timber is chiefly used in the lake district of the South Island. Durable and adapted for masts and oars, and for cabinet and cooper's work. Grows in the North Island on the mountain-tops, but abundant in the South Island at all altitudes to 3,000 feet.

Fagus fusca, Hook.

Tawhai, Tawhairaunui, Black-birch of Auckland and Otago (from colour of bark), Red-birch of Wellington and Nelson (from colour of timber).—This is a noble tree 60–90 feet high; the trunk 5–8 feet in diameter. The timber is excessively tough and hard to cut. It is highly valued in Nelson and Wellington as being both strong and durable for all purposes. It is found from Kaitaia in the North Island to Otago in the South Island, but is often locally absent from extensive districts, and grows at all heights up to 3,000 feet altitude.

Fagus solandri, Hook.

White-birch of Nelson and Otago (from colour of bark), Black-heart Birch of Wellington.—A lofty, beautiful evergreen tree 100 feet high; trunk 4–5 feet in diameter. The heart timber is darker than that of *Fagus fusca,* and is very durable. The wood is well adapted for fencing and bridge piles, and the bark is useful as a tanning material. This tree occurs only in the southern part of the North Island, but is abundant in the South Island, at 3,000–5,000 feet altitude.

Order—MYRTACEÆ.

Genus—*Leptospermum*, Forst.

Leptospermum scoparium, Forst.

Kahikatoa, Tea-tree of Cook.—It is ornamental, and useful for fuel and fencing; generally a small shrub, but occasionally 20 feet in height in the South. Abundant throughout the Islands.

Leptospermum ericoides, A. Rich.

Manuka.—A slender tree 10–80 feet high, highly ornamental, more especially when young. The timber can be had 28–30 feet long, 14 inches in diameter at the butt, and 10 inches at the small end. The wood is hard and dark-coloured, largely used at present for fuel and fencing, axe-handles and sheaves of blocks, and formerly by the Natives for spears and paddles. The old timber, from its dark-coloured markings, might be used with advantage in cabinet-work, and its great durability might recommend it for many other purposes. Highly valued in Otago for jetty and wharf piles, as it resists the marine worm better than any other timber found in the district. It is extensively used for house-piles. The lightest-coloured wood, called "white manuka," is considered the toughest, and forms an excellent substitute for the "hornbeam" in the cogs of large spur-wheels. It is abundant as a shrub, and is found usually on the poorest soils, but is rare as a tree in large tracts to the exclusion of other trees.

Genus—*Metrosideros*, Br.

Metrosideros lucida, Menzies.

Rata, Ironwood.—A very ornamental tree; attains a height of 30–60 feet, and a diameter of 2–10 feet. The timber of this tree forms a valuable cabinet wood; is of a dark-red colour; splits freely. It has been much used for knees and timbers in ship-building, and would probably answer well for cogs of spur-wheels. Grows rarely in the North Island, but is abundant in the South Island, especially on the West Coast.

Metrosideros robusta, A. Cunn.

Rata.—A tall erect tree, 50–60 feet high; diameter of trunk 4 feet, but the descending roots often form a hollow stem 12 feet in diameter. Timber closely resembles the last-named species, and is equally dense and durable, while it can be obtained of much larger dimensions. It is used for ship-building, but for this purpose is inferior to the pohutukawa. On the tramways at the Thames it has been used for sleepers, which are perfectly sound after some years' use. Grows in the North Island; usually found in hilly situations from Cape Colville southwards.

Metrosideros tomentosa, A. Cunn.

Pohutukawa.—This tree has numerous massive arms; its height is 30–60 feet; trunk 2–4 feet in diameter. The timber is specially adapted for the purposes of the shipbuilder, and has usually formed the framework of the numerous vessels built in the northern districts. Grows on rocky coasts, and is almost confined to the Provincial District of Auckland.

Order—MELIACEÆ.

Genus—*Dysoxylum,* Blum.

Dysoxylum spectabile, Hook.

Kohekohe.—A large forest tree, 40–50 feet high. Its leaves are bitter, and used to make a stomachic infusion; wood tough, but splits freely, and is considered durable as piles under sea-water. Grows in the North Island.

Genus—*Eugenia.*

Eugenia maire, A. Cunn.

Mairetawhake.—A small tree about 40 feet high; trunk 1–2 feet in diameter. Timber compact, heavy, and durable. Used for mooring-posts and jetty-piles on the Waikato, where it has stood well for many years. It is highly valued for fencing. Common on swampy land in the North Island.

Order—ONAGRARIEÆ.

Genus—*Fuchsia,* Linn.

Fuchsia excorticata, Linn.

Kotukutuku. The fruit is called Konini.—A small and ornamental tree, 10–30 feet high; trunk sometimes 3 feet in diameter. It appears to furnish a durable timber. House-blocks of this wood, which had been in use in Dunedin for more than twenty years, were still sound and good. The wood might be used as dye-stuff, if rasped up and bled in the usual way, and, by mixing iron as a mordant, shades of purple may be produced even to a dense black, that makes good writing ink. The juice is astringent and agreeable, and yields a medical extract. Its fruit is pleasant, and forms the principal food of the wood-pigeon. Grows throughout the Islands.

Order—ARALIACEÆ.

Genus—*Panax,* Linn.

Panax crassifolium, Dcne. and Planch.

Horoeka, Ivy Tree.—An ornamental, slender, and sparingly branched tree. It has a singularly graceful appearance in the young state, having long reflexed leaves. The wood is close-grained and tough. Common in forests throughout the Islands.

Order—Corneæ.

Genus—*Griselinia*, Forst.

Griselinia littoralis, Raoul.

Pukatea, Broadleaf.—An erect and thickly-branched bush-tree, 50–60 feet high; trunk 3–10 feet in diameter. Wood splits freely, and is valuable for fencing and in shipbuilding; some portions make handsome veneers. Grows chiefly in the South Island and near the coasts.

Order—Compositæ.

Genus—*Olearia*, Mœnch.

Olearia avicenniæfolia, Hook.

Mingimingi, Yellow-wood.—An ornamental shrub-tree; flowers numerous; trunk 2 feet in diameter. Wood close-grained, with yellow markings, which render it desirable for cabinet-work; good for veneers. Occurs in South Island.

Olearia nitida.

An ornamental shrub-tree, 20 feet high and 2 feet in diameter. Wood close-grained, with yellow markings; useful for cabinet-work. Found in the mountainous region of the North Island and throughout the South Island.

Olearia cunninghamii.

An ornamental shrub-tree, 12–20 feet high, with very showy flowers. Found abundantly on west coast of South Island, and not uncommon in North Island.

Order—Ericeæ.

Genus—*Dracophyllum*, Lab.

Dracophyllum longifolium, Br.

Neinei.—An ornamental shrub-tree with long grassy leaves. Wood white, marked with satin-like specks, and adapted for cabinet-work. Grows in South Island and in Lord Auckland's Group and Campbell Island; none of the South Island specimens are as large in the foliage as those in Auckland Islands. In the vicinity of Dunedin attains a diameter of 10 to 12 inches.

Order—Verbenaceæ.

Genus—*Vitex*.

Vitex littoralis, A. Cunn.

Puriri.—A large tree, 50–60 feet high; trunk 20 feet in girth. Wood hard, dark olive-brown, much used; said to be indestructible under all conditions. Grows in the northern parts of the North Island only. Considered very valuable for railway-sleepers.

Order—LAURINEÆ.

Genus—*Nesodaphne*, Hook.

Nesodaphne tarairi, Hook.

Tarairi.—A lofty forest tree, 60–80 feet high, with stout branches. Wood white, splits freely, but not much valued. Grows in northern parts of North Island.

Nesodaphne tawa, Hook.

Tawa.—A lofty forest tree, 60–70 feet high, with slender branches. The wood is light and soft, and is much used for making butter-kegs. Grows in the northern parts of the South Island, and also in the North Island, chiefly on low alluvial grounds; is commonly found forming large forests on river-flats.

Order—MONIMIACEÆ.

Genus—*Atherosperma*, Lab.

Atherosperma novæ-zealandiæ, Hook.

Pukatea.—Height, 150 feet, with buttressed trunk 3–7 feet in diameter; buttresses 15 feet deep at the base; wood soft and yellowish, used for small boat planks. A variety of this tree has dark-coloured wood that is very lasting in water, and greatly prized by the Maoris for making canoes. Grows in the North Island, and northern parts of the South Island.

Genus—*Hedycarya*, Forst.

Hedycarya dentata, Forst.

Kaiwhiria.—A small evergreen tree, 20–30 feet high; the wood is finely marked and suitable for veneering. Grows in the North Island, and as far south as Akaroa in the South Island.

Order—PROTEACEÆ.

Genus—*Knightia*, Br.

Knightia excelsa, Br.

Rewarewa.—A lofty slender tree, 100 feet high. Wood handsome, mottled red and brown, used for furniture and shingles, and for fencing, as it splits easily. It is a most valuable veneering wood. Common in the forests of the North Island, growing upon the hills in both rich and poor soils.

Order—MAGNOLIACEÆ.

Genus—*Drimys*.

Drimys axillaris, Forst.

Horopito, Pepper-tree, Winter's Bark.—A small slender evergreen tree, very handsome. Whole plant aromatic and stimulant; used by the Maoris for various diseases. Wood very ornamental in

cabinet-work, making handsome veneers. Grows abundantly in forests throughout the Islands. At altitudes of 1,000 feet the foliage becomes dense and reddish-coloured.

Drimys colorata, Raoul.

This is a very distinct species, very common near Dunedin; it is a very ornamental shrub-tree, with leaves blotched with red.

Order—VIOLARIEÆ.

Genus—*Melicytus,* Forst.

Melicytus ramiflorus, Forst.

Mahoe, Hinahina.—A small tree, 20–30 feet high; trunk often angular, and 7 feet in girth. The wood is soft and not in use. Abundant throughout the Islands as far south as Otago. Leaves greedily eaten by cattle.

Order—MALVACEÆ.

Genus—*Hoheria,* A. Cunn.

Hoheria populnea, A. Cunn.

Houhere, Ribbonwood of Dunedin.—An ornamental shrub-tree, 10–30 feet high. Bark fibrous and used for cordage, and affords a demulcent drink. Wood splits freely for shingles, but is not durable. Grows abundantly throughout the Islands. Bark used for making a tapa cloth by the Maoris in olden times.

Order—TILIACEÆ.

Genus—*Aristotelia.*

Aristotelia racemosa, Hook.

Mako.—A small handsome tree, 6–20 feet high, quick-growing, with large racemes of reddish nodding flowers. Wood very light, and white in colour, and might be applied to the same purposes as the lime-tree in Britain; it makes good veneers.

Genus—*Elæocarpus,* Linn.

Elæocarpus dentatus, Vahl.

Hinau.—A small tree, about 50 feet high, and 18 inches thick in stem, with brown bark which yields a permanent blue-black dye, which is used for tanning; it is used by the Maoris for colouring mats and baskets. Wood a yellowish-brown colour and close-grained; very durable for fencing and piles. Common throughout the Islands.

Order—OLACINEÆ.

Genus—*Pennantia,* Forst.

Pennantia corymbosa, Forst.

Kaikomako.—A small, very graceful tree, with white sweet-smelling flowers; height 20–30 feet. Wood used by the Maoris

for kindling fires by friction. Grows on the mountains of the North Island, and more abundantly throughout the South Island.

Order—RHAMNEÆ.

Genus—*Discaria*, Hook.

Discaria toumatou, Raoul.

Tumatakuru, Wild Irishman.—A bush or small tree with spreading branches; if properly trained would form a handsome hedge that would be stronger than whitethorn. The spines were used by the Maoris for tatooing.

Order—SAPINDACEÆ.

Genus—*Dodonæa*, Linn.

Dodonæa viscosa, Forst.

Ake.—A small tree, 6–12 feet high. Wood very hard, variegated black and white; used for Maori clubs; abundant in dry woods and forests.

Genus—*Alectryon*, Gærtner.

Alectryon excelsum, DC.

Titoki.—A beautiful tree with large panicles of reddish flowers. Trunk 15–20 feet high, and 12–20 inches in diameter. Wood has similar properties to ash, and is used for similar purposes. Its toughness makes it valuable for wheels, coach-building, &c.; the oil of the seeds was used for anointing the person. Grows in the North and South Islands; not uncommon in forests.

Order—CORIARIEÆ.

Genus—*Coriaria*, Linn.

Coriaria ruscifolia, Linn.

Tupakihi, Tree Tutu.—A perennial shrub 10–18 feet high; trunk 6–8 inches in diameter. The so-called berries (fleshy petals) vary very much in succulence, the less juicy bearing seeds which, according to Colenso, are not poisonous. The juice is purple, and affords a grateful beverage to the Maoris; and a wine, like elderberry wine, has been made from them. The seeds and leaves contain a poisonous alkaloid, and produce convulsions, delirium, and death, and are sometimes fatal to cattle and sheep. Abundant throughout the Islands.

Order—LEGUMINOSÆ.

Genus—*Sophora*, Linn.

Sophora tetraptera, Aiton.

Kowhai.—A small or middling-sized tree. It has a splendid appearance, with large pendulous yellow flowers. Wood red; valu-

able for fencing, being highly durable; it is also adapted for cabinet-work. It is used for piles in bridges, wharves, &c. Abundant throughout the Islands.

Order—SAXIFRAGEÆ.

Genus—*Carpodetus*, Forst.

Carpodetus serratus, Forst.

Tawiri, White Mapau, White-birch (of Auckland).—A small tree, 10–30 feet high; trunk unusually slender; branches spreading in a fan-shaped manner, which makes it of very ornamental appearance; flower white, profusely produced. The wood is soft and tough, and might be used in the manufacture of handles for agricultural implements and axes. Grows in the North and South Islands; frequent by the banks of rivers.

Genus—*Weinmannia*, Linn.

Weinmannia racemosa, Forst.

Towhai, Kamahi.—A large tree; trunk 2–4 feet in diameter, and 50 feet high. Wood close-grained and heavy, but rather brittle; might be used for plane-making and other joiners' tools, block-cutting for paper and calico printing, besides various kinds of turnery and wood-engraving. The bark of this tree is largely used for tanning. The extract of bark is chemically allied to the gum kino of commerce, their value being about equal. Grows in the middle and southern parts of the North Island and throughout the South Island.

Order—RUBIACEÆ.

Genus—*Coprosma*, Forst.

Coprosma linariifolia, Hook.

Karamu.—An ornamental shrub-tree; wood close-grained and yellow; might be used for turnery. Grows in mountain localities of the North and South Islands.

Several other species of this genus grow to a considerable size, and have ornamental timber. It has been proposed to use the berries of *C. baueriana* as a substitute for coffee.

Order—JASMINEÆ.

Genus—*Olea*, Linn.

Olea cunninghamii, Hook. fil.

Black Maire.—40–50 feet high, 3–4 feet in diameter; timber close-grained, heavy, and very durable. Much of this very valuable timber is being destroyed in clearing the land.

Order—SANTALACEÆ.

Genus—*Santalum*, Linn.

Santalum cunninghamii, Hook. fil.

Maire.—A small tree 10–15 feet high, 6–8 inches in diameter; wood hard, close-grained, heavy. Used by the Maoris in the manufacture of war implements. Has been used as a substitute for box by wood-engravers.

MINERAL WATERS.

PRINCIPAL MINERAL SPRINGS.

New Zealand is singularly rich in springs of water that hold mineral salts in solution, and some of these are already noted for their valuable medicinal properties.

Both hot and cold springs are found, the former being, with few exceptions, confined to the districts of the North Island where volcanic forces have been active during the latest Tertiary period, and are not yet altogether dormant. A few thermal springs are found to escape from the Upper Mesozoic rocks, in localities where the source of heat can only be attributed to chemical decomposition of bituminous matters and sulphides; and in a few instances warm waters spring from Palæozoic rock-formations in the South Island. The cold mineral springs have a wider distribution, but have only as yet been examined from comparatively few localities.

The mineral waters of New Zealand are classified, from analyses that have been made in the Colonial Laboratory, under the following groups:—

Saline.—Containing chiefly chloride of sodium.

Alkaline.—Containing carbonates and bicarbonates of soda and potash.

Alkaline Siliceous.—Waters containing much silicic acid, but changing rapidly on exposure to the atmosphere, and becoming alkaline.

Hepatic or Sulphurous.—Waters the prominent character of which is the presence of sulphuretted hydrogen and sulphurous acid.

Acidic Waters.—In which there is an excess of mineral acids, such as hydrochloric and sulphuric acid.

The following is a list of the best-known mineral springs, full details concerning which are to be found in the Official Laboratory Reports:—

No.	Name and Locality.	Temp. Fahrenheit.	Grains per Pint.	Chemical Character of Water.
	Bay of Islands District.	Deg.		
1	Ohaeawai and Pakaraka	60–116	16·8	Acid, aluminous; deposits mercury.
	Hauraki District.			
2	Waiwera	110	17·7	Alkaline, saline.
3	Puriri	60	67·1	Carbonated, alkaline.
	Bay of Plenty.			
4	White Island Lake	97–212	1850·8	Strongly acid.
5	White Island Springs	210	26·1	,,
	Rotomahana.			
6	Pink Terrace Geyser	208	19·3	Sulphurous.
7	White Terrace Geyser	210	18·0	Alkaline.
	Whakarewarewa.			
8	Turikore, or Spirit Bath	96–120	10·9	Sulphurous.
9	Koroteoteo, or Oil Bath	214	13·0	Caustic, alkaline.
10	Ngatarawa, Gas Pool	124	8·4	Sulphurous.
11	Papatangi, Lobster-pot	110	5·7	,,
	Arikikapakapa.			
12	Mud Bath...	98	9·2	Saline, acidic.
13	Sulphur Pool	160	6·8	Acidic.
14	Sulphur Spring	73–98	10·0	,,
15	Sulphur Stream	80	8·5	,,
16	Mud Lake	65	6·8	,,
	Rotorua.			
17	Tapui te Koutou, Graham's Farm Bath	90–108	9·1	Alkaline.
18	Kuirau, Washing Spring	136–156	9·9	Alkaline, siliceous.
19	Waihunuhunukuri, Lake House Clear Bath	130–170	7·3	Alkaline.
20	Lake House Acid Bath	150	11·4	Acidic.
21	Waikite (*a*), Morrison's Hotel Bath ...	120	9·4	Alkaline.
22	Waikite (*b*), Scott's Bath	116	9·6	,,
23	Hinemaru, Hughes's Baths	170	16·7	,,
24	Te Kauwhanga (*a*), Cameron's Bath ...	115	10·1	Acidic.
25	Te Kauwhanga (*b*), Painkiller ...	204	13·8	Acidic and hepatic.
26	Perekari, Sulphur Point Boiling Pool ...	130–150	7·0	Acidic.
27	Mud Bath, Sulphur Point	120	7·8	Acidic and hepatic.
28	Hot Pool, Sulphur Point	200	12·1	Acid.
29	Whangapipiro, Madame Rachel's Bath ...	170–210	14·7	Alkaline and siliceous.
30	Otamawhata	144	11·4	Alkaline.
31	Hospital Lake	66	11·3	Acidic.
32	Te Pupunitanga, Priest's Bath ...	94–110	12·1	,,
	Rotoiti.			
33	Te Kute, mud lake at Tihitari ...	100–212	6·1	Acidic, hepatic.
34	Te Mimi, hot waterfall, from 33° C. ...	90–112	3·8	Acidic.

No.	Name and Locality.	Temp. Fahrenheit.	Grains per Pint.	Chemical Character of Water.
	Taupo District.	Deg.		
35	Rotokawa, Black Water	192	17·8	Acidic.
36	„ Yellow Water	152	22·0	„
37	Wairakei, Piroirori, or White Water ...	112	1·8	Alkaline.
38	Ruahine, Crow's Nest	180	19·2	„
39	„ Witches' Cauldron	192	20·8	„
40	„ Ohinekahoro	195	23·0	„
41	„ spring on flat near track ...	132	2·2	Feebly saline.
42	Otumahike, Acacia	136	3·9	Feebly alkaline.
43	Lofley's Gully, McPherson's ...	96	1·9	„
44	„ cold stream	76	1·3	„
45	„ warm stream ...	114	2·8	„
46	„ Sumach	106	3·0	„
47	„ Source No. 1 ...	106	3·0	Alkaline, siliceous.
48	„ Source No. 2 ...	136	19·0	Alkaline, saline.
49	„ Kokowai	104	2·0	Feebly saline.
50	Waipahihi, A.C. Bath No. 1	110	4·7	Chlorinated saline.
51	„ „ No. 2	146	5·7	Saline.
52	„ Tea-tree Spring	170	13·4	Alkaline, siliceous.
53	„ Source No. 1	160	10·8	Alkaline.
54	„ Source No. 2	166	13·0	„
55	„ Waipahihi Stream ...	98	8·6	Saline.
56	Left bank, Waikato, Waiariki ...	125	10·8	Chlorinated saline.
	Waikato District.			
57	Whangape...	160–200	6·0	Alkaline.
	Ruapehu District.			
58	Onetapu, Waikato	70	58·0	...
	East Cape District.			
59	Roparoa, Waiapu	Cold	...	Saline, bituminous.
60	Manutahi „	„	...	„
61	Pepoti „	„	...	Hydrocarbon gas.
62	Waipaoa, Poverty Bay	„	...	Bituminous.
63	Waipiro, Waiapu	144	...	Calcareous, bituminous.
	Wellington District.			
64	Wallingford	60	10·4	Acid.
65	Pahua	Cold	184·2	Alkaline.
66	Burton's Spring	„	...	...
67	Akiteo (*a*)	„	62·4	Alkaline.
68	„ (*b*)	„	4·8	Sulphurous.
	South Island.			
69	Hanmer Plain Springs, Amuri ...	90–104	10·8	Alkaline.
70	Sumner Lake Springs „ ...	93	2·3	Saline.
71	Amberley Spring, Canterbury ...	Cold	11·7	Chalybeate.
72	Wickliffe Bay Spring, Otago	...	34·6	Saline.
73	Gibson's Spring, Southland	Cold	2·3	Alkaline.

1. *Ohaeawai,* Auckland. A group of springs used as baths, 17 miles from Bay of Islands, the waters of which are acidic, depositing sulphur and alum on cooling. Silica is only deposited as a granular sediment. These springs are chiefly interesting from their being accompanied by an escape of mercurial vapour, which deposits cinna-

bar and metallic mercury. Their medicinal action is tonic and chalybeate, and they have a specific alterative action in skin diseases.

2. *Waiwera,* on the coast, 30 miles north of Auckland. A powerful escape of weakly alkaline and saline water, extensively used as baths for rheumatic and dyspeptic complaints; used internally it has also a mild antilithic action. This spring is largely resorted to, and most comfortable accommodation is provided for visitors.

ANALYSIS.

	Grains per Gallon.
Chloride of sodium	116·715
,, potassium	·091
,, lithium	traces
Iodide of magnesium	traces
Sulphate of soda	·383
Bicarbonate of soda	87·513
,, lime	10·692
,, magnesia	·954
,, iron	·683
Alumina	traces
Silica	2·464
	219·495

3. *Puriri,* about 10 miles from Grahamstown. A cold effervescent water, having valuable properties from the presence of a large percentage of alkaline carbonates. It is bottled both as still and aërated water, and is coming into repute as an antilithic aperient, and would probably be useful in cases of acid dyspepsia and in disorders of the kidney and bladder. In chemical properties it approaches very closely to Fachingen and Ems waters, of Nassau in Germany.

	Grains per Gallon.
Chloride of sodium	21·938
Iodide of magnesium	traces
Sulphate of soda	·940
,, potash	4·938
Carbonate of iron	traces
Bicarbonate of lime	28·506
,, magnesia	25·625
,, soda	452·393
,, lithia	traces
Silica	2·772
Phosphoric acid	not determined
	537·112

4–5. *White Island.* A conical island in the Bay of Plenty, formed by the summit of an extinct volcanic mountain rising out of deep water. The crater is occupied by a lake of strong mineral water, which is fed by intermittent geysers and boiling springs which surround it. All these waters are intensely acid, and deposit sulphate of lime; while the accompanying vapours form irregular deposits of pure sulphur. The first water is too powerful to be used medicinally in its natural state, but might be turned to valuable account in certain chemical manufactures.

6–34. Are associated geographically as all coming from the famous Rotorua and Rotomahana Districts. They, however, present considerable variety in quality, and may be classed as follows:—

6–17. *Alkaline and Siliceous Waters.* These differ from the ordinary alkaline waters in the presence of silicic instead of carbonic acid as the combining agent. They are remarkable from their building extensive mounds and terraces composed of silica deposited by the cooling water, and involving as it solidifies a certain amount of granular silica, which is held in mechanical suspension; in this manner the wonderful white and pink terraces of Rotomahana and the domes of Whakarewarewa have been formed. This class of water invariably contains carbonic-acid gas, and in some cases also sulphuretted hydrogen in large quantity, the oxidation of which leads to the formation of sulphurous and sulphuric acid and the liberation of hydrochloric acid, and in this way gives rise to the acidic waters. When used as baths they have an undoubted alterative action, and are very useful in rheumatic affections, especially in gouty constitutions. This is probably due to the specific action of silicates in promoting the discharge of uric acid from the system, as has lately been pointed out by French chemists.

Acidic Waters. In the case of these waters the carbonates have been wholly eliminated, and the alkaline salts are formed by a mineral acid, either sulphuric or hydrochloric. In some cases the acid is greatly in excess, forming a bath which has a powerful action upon the liver and upon diseases dependent on the derangement of that important organ. In some the presence of sulphurous and hydrosulphuric acid in large quantities gives these baths great efficacy in cutaneous diseases.

The following are the analyses of four types of the mineral waters in the Rotorua District:—

32. "Te Pupunitanga," commonly known as the "Priest's Bath;" aluminous and strongly acid (reaction acid).

	Grains per Gallon.
Sulphate of soda	19·24
„ potash	traces
„ lime	7·41
„ magnesia	3·03
„ alumina	21·67
„ iron	1·24
Sulphuric acid	22·12
Hydrochloric acid	3·65
Silica	18·41
	96·77
Sulphuretted hydrogen	2·98
Carbonic-acid gas	2·16

29. "Whangapipiro," commonly known as "Madame Rachel's Bath;" saline waters with silicates (reaction alkaline).

	Grains per Gallon.
Chloride of sodium	69·43
„ potassium	3·41
„ lithium	traces
Sulphate of soda	11·80
Silicate of soda	18·21
„ lime	4·24
„ magnesia	1·09
Iron and alumina oxides	2·41
Silica	5·87
	116·46
Carbonic-acid gas	3·79

24. "Te Kauwhanga" (*a*), commonly known as "Cameron's Bath;" hepatic, feebly saline, with excess of acid (reaction acid).

	Grains per Gallon.
Sulphate of soda	44·54
Chloride of potassium	1·67
„ sodium	12·04
„ calcium	5·22
„ magnesia	1·28
„ alumina	0·62
Silica	9·22
Hydrochloric acid	5·92
	80·51
Sulphuretted hydrogen	4·42
Carbonic acid gas	1·96

8. "Turikore." Faintly acid reaction, which turns to alkaline on boiling.

	Grains per Gallon.
Silicate of soda	16·32
„ lime	1·61
„ magnesia	1·14
„ iron	·39
Sulphate of soda	13·47
Chloride of potassium	1·24
„ sodium	53·61
Phosphate of alumina	traces
	87·78

The following abstract of a most interesting paper communicated to the *Australasian Medical Gazette* gives the actual experience of the usefulness of these springs obtained by Dr. Hope Lewis, the Medical Officer in charge of the Sanatorium:—

Only a few years ago the Rotorua District became known to those eager tourists whose thirst for sight-seeing gave them the energy to undertake long journeys on horseback with fare in Maori whares, and to those sufferers from chronic diseases, especially rheumatism, who, having exhausted the Pharmacopœia, gave the waters the last chance of achieving an alleviation or a cure of their ailment.

A road was at last made from Tauranga, a seaport in the Bay of Plenty, about forty-two miles from the Maori village of Ohinemutu, and the district then became the resort of tourists each summer. At the same time the number of invalids increased, and they, living in whares rented from Maoris, bathed daily in the warm springs near which their abodes stood. After using the waters, both for bathing in and drinking haphazard, one after another, many would feel much relieved, some cured, and almost all better for the change. No wonder the most powerful of the springs have received fanciful names, such as "The Painkiller," "The Lobster-pot," "The Oil Bath," "Madame Rachel," and many named after individuals who were cured by their use. Were any one to believe a hundredth part of the extraordinary tales of cures with which the coachdrivers regale their passengers *en route* to the district, any of the "thousand ills" would meet with its appropriate bath and cure here. Such, however, experience shows is not the case.

Being furnished by the Government Analyst with analyses of the principal waters near Lake Rotorua (on the shores of which the Native settlement of Ohinemutu and the new Township of Rotorua stand), I have had opportunities of watching closely many cases of disease that have been treated by bathing. I shall confine myself in my remarks to the springs in the immediate neighbourhood of Rotorua.

The various mineral waters are classified as alkaline siliceous, acidic, and acidic and hepatic or sulphurous.

Of these three varieties several exist in the immediate vicinity of the new township, and the bath pavilion which has been erected, and is now in working order, has been supplied with two waters, one acidic, and one alkaline siliceous—viz., (1) Te Pupunitanga, commonly known to visitors

as the "Priest's Bath" (acidic); and (2) Whangapipiro, commonly known as "Madame Rachel" (alkaline siliceous). The origin of these sobriquets is somewhat curious, and, having a more easy pronunciation than the Maori names, they have received too common use.

No. 1. From the fact that a well-known Roman Catholic priest frequented, in early days, with much benefit, this now well-known spring. This water issues from porous pumice soil, part of which it has solidified by its deposit of silica, so making for itself a more or less perfect set of tubes. There is a constant ebullition of gas (H_2S) from the spring. Its temperature varies from 99° Fahr. to 104° Fahr. It rises 15 inches above the lake level, on the edge of which it stands, and into which it empties itself, depositing as it flows yellow flocculent sulphur. Silver held over this water, or dipped in it, becomes blackened, as also does gold that is alloyed with that metal. It has a most powerful action on the skin, causing redness of the whole surface immersed, and in some cases causing a small vesicular eruption of the skin. A curious fact that patients have observed is its astringent action on the skin, which is quite contrary to the effect of an ordinary warm bath. As before observed, sulphuretted hydrogen is given off by this water, and some cases have come under my notice in which fainting has been caused by its inhalation. That sulphur is absorbed into the system by the use of this water is proved by the fact that after removal from the locality silver worn on the person is still blackened. On few has it any purgative effect, but there are cases on record in which some diarrhœa has resulted. I apprehend this is the result of an increased flow of bile, which I am led to believe is the case from the benefit that bilious and dyspeptic patients have received from bathing in this water, and also from the change produced in the colour of the stools. In a case of locomotor ataxy, which was treated by this bath and one of the hepatic sulphurous ones for a course of six weeks, a crop of boils was induced. Of one fact I am assured: that is, that it acts as a tonic and alterative generally, and that it has an eminently stimulating effect on that organ, so often at fault with obscure symptoms, the liver. This water has the power of destroying the *Acarus scabiei* with rapidity. I have seen in a short time a most severe case of scabies in a Maori completely cured by repeated bathing in this spring. That the vegetable parasitic affections of the skin will be benefited by the use of these waters I also hope to be able to prove soon. This water, as will be seen from the analysis, is not fitted for taking internally on account of the amount of free sulphuric acid it contains. One very similar water was taken by a curious tourist, who, to his pain, discovered its astringent qualities. It was beneficial, however, in a case of relaxed sore-throat, when employed as a gargle. For a vaginal douche this and other waters here have been used with marked benefit in cases of leucorrhœa, endometritis, and uterine atomy, especially about the time of the cessation of the menses. The ease and comfort with which the waters can be used in these cases is apparent. In functional dysmenorrhœa, accompanied with neuralgia, they have proved exceedingly beneficial.

The appetites of patients under a course of bathing calls for remark. In every case that has come under my notice the appetite for food, when it has been failing, has been increased by regular bathing; and in cases where patients have felt much enervated while undergoing a course, still they have been surprised that their desire for food increased, and its subsequent easy digestion was accomplished.

No. 2 received its name from the fact of its rendering the cuticle so soft and pliable as to resemble to some the enamelling process of the celebrated "beautifier." The luxury, for it is such, of bathing in this water is due to its softness, and to the amount of silicic acid and silicates that it contains. When the body is immersed a gloss is given to the skin which is most characteristic of the alkaline siliceous waters in the district. As the water flows from the spring, which is a deep, clear cauldron, at a temperature of about 174° Fahr., it deposits a steel-grey coating of silica on the bed of the stream in the form of a rock. By this process the beautiful terraces at Rotomahana have been formed, one of which is white, the other being slightly tinged pink, due to a small amount of iron oxide in solution. This class of water, of which Whangapipiro is a typical example, has been employed principally in the treatment of gout, gouty arthritis, chronic rheumatism, rheumatoid arthritis, and forms of myalgia, especially lumbago of a rheumatic kind; also sciatica. For these complaints, and many others too numerous to mention, invalids have alternated the use of the alkaline waters with the hepatic sulphurous, of one of which I append an analysis as a type.

The cases which seem most benefited by their use are those semi-convalescent from the acute forms of rheumatism and gout. These, as a rule, rapidly improve after a few days, and make good recoveries; but the chronic cases take a far longer time than patients will or can give to their treatment, as a rule, so far. It is only due to these waters to state that, though they have not removed synovial fringes, nor relaxed anchylosed joints, to my knowledge, still they appear in many cases to reduce fluid in joints, and they certainly eradicate that wearing pain which is so harassing at times to the rheumatic and gouty, when their use is persevered in. Of the action of this water when taken internally I cannot yet speak with certainty. Several cases of lumbar and sciatic myalgia produced in miners who have been employed in the damp mines on the west coast of the South Island of New Zealand have been cured by the use of a strongly siliceous water in the form of a heavy douche.

I have only had an opportunity of watching one case of psoriasis, but the marked benefit that was produced leads me to hope that in those cases of *Psoriasis inveterata* there is yet one more remedy to try after the usual course has been adopted with no good result. In January this year a gentleman, A. B., æt. 42, was sent here by his medical advisers as a last chance. I saw him the morning after his arrival. He was a most typical example of *Psoriasis inveterata*, the whole body and limbs being covered with the disease, the face and hands excepted. He had taken all the known medicines, including quiniæ arsenias, and used all the applications, including chrysophanic acid ointment. The duration of the disease was four years. Family history of skin disease on both sides. No syphilitic taint. Disease had steadily increased up to six months ago; since then had been stationary. The amount of desquamation was very great, and there was pain in every movement of the large joints. There was loss of sleep and appetite, and sitting down was performed with much pain. I may mention that during the greater portion of the coach journey up he was kneeling, that being the position in which he felt least pain. He began a course of bathing at one of the alkaline siliceous springs named Turikore,* and persevered for about four months, each week of which time he pronounced himself as improving. At first,

* No. 8 in table on p. 134.

owing to being unaccustomed to so great a heat (103° to 107°), he felt the effects of the water very much, and was unable to stay in a bath more than fifteen or twenty minutes, but gradually he became able to bear immersion for an hour three or four times a day. In about a month there was marked improvement, and in six weeks he could walk four miles without pain. The scaling was much less, and altogether he was a new man. After four months' treatment he was forced to return to his duties, and, though he still had a considerable eruption about the body, it was of a mild form, and he was able to perform his duties of life as well as ever. Had he been in a position to live near the springs, I firmly believe, from what I saw of the case, that a cure would have resulted, and this in a case which I could not have believed would have been benefited by anything, when I first examined the patient and had heard the whole of his history. I may add that, after bathing, common lard or vaseline was applied occasionally to the most painful parts. The treatment by this particular bath was empirical, but I was led to advise it on account of the history of several cases of eczema and scorbutic sores that had received great benefit from its use.

35–56. With the exception of the first two their general characters are saline and faintly acid. They are reported to be suitable for internal and external use, as alteratives, in scorbutic and tubercular diseases, also in chronic nervous affections and cutaneous eruptions. The presence of iodine in these waters, which was formerly reported, has been disproved by recent analyses of authentic samples.

57. Whangape, Waikato, is a hot alkaline water, having a composition similar to those of Puriri and Waiwera.

58. Onetapu Desert, at the sources of the Waikato and Wangaehu Rivers. This powerful spring, which issues at the base of Ruapehu, is so strongly charged with sulphates of iron and alumina as to taint the water of the latter river from its source to the sea, a distance of seventy miles. It is only one of the many mineral springs which occur in the still active volcanic district of Tongariro.

59–62. In the East Cape and Poverty Bay District are four—out of some seventeen different springs which have been discovered—that yield hydrocarbons, either in the form of gas or oil, and associated with saline waters. The source of these springs is probably certain bituminous shales at the base of the Cretaceous formation.

63. Waipiro is interesting as being a hot spring in the same district (in which there is no evidence of any volcanic action), and as depositing immense quantities of carbonate of lime in acicular crystals. This lime-deposit is built up in the form of a wall, marking the line of fissure through which the water escapes.

64, 65. Are cold springs in the Wellington District, and belong to the class of saline waters, but are generally feebly acid. Springing from rocks of Lower Secondary formation, they are interesting from the large proportion of iodine and other exceptional elements which they

contain. Pahua is the most notable in this respect, and has the following composition :—

	Grains per Gallon.
Chloride of sodium	1,303·329
,, potassium	·501
,, magnesium	34·960
,, calcium	120·885
Iodide of magnesium	·582
Bromide of magnesium	traces
Sulphate of lime	3·026
Phosphate of alumina	·641
,, iron	traces
,, lime	·430
Bicarbonate of lime	6·451
Silica	1·696
Iodine, free	1·595
	1,474·096

Total quantity of iodine to the gallon (free and combined), 2·127 grains.

66. Burton's Taipo, in addition to iodine, contains traces of arsenic.

67, 68. Akiteo (*a*) is a strong saline water containing iodides and bromides, while Akiteo (*b*) is an aërated chalybeate water, and would be valuable as a tonic, being similar to the springs at Pyrmont, Waldeck, and Recoaro, Venetia. Aërated chalybeate waters of medicinal value are found in many other parts of New Zealand; among these may be mentioned a locality near Whangarei, in the North, and Chain Hills, near Dunedin, in the South.

69. The springs which occur at the Hanmer Plains, Amuri, are alkaline, with a strong escape of sulphuretted hydrogen, and would form useful baths in rheumatic and cutaneous diseases.

70. At the distance of a few miles from Sumner Lake water has a temperature of 93° Fahr., as it gushes from the sandstone rock, but it does not contain sufficient matters in solution to entitle it to rank as a mineral water.

71. Amberley. This was analysed and reported on by Professor Bickerton, of the Canterbury College, as a chalybeate water, but unfit for use on account of the organic matter present. The analysis gave the following quantitative results :—

	Grains per Gallon.
Total dissolved solids	37·6
Volatile	8·8
Fixed	28·8
Carbonate of lime	3·6

Carbonate of magnesia	2·2
Chlorine	10·5
Iron protoxide	2·3
Free ammonia	·069
Albuminoid ammonia	·034
Sediment	165·2

72. Wickliffe Bay, Otago. An analysis of this water is given by Professor Black, of Otago University. It appears to be a saline water :—

	Grains per Gallon.
Sulphuric acid (combined)	39·3
Chlorine	112·0
Magnesia	18·3
Lime	11·5
Alkalies	83·0
Carbonic acid (combined)	12·6

73. Gibson's Spring, Southland, is a water which is stated to be a specific in diarrhœa, and contains a large amount of organic matter, to some astringent quality of which its medicinal qualities are probably due.

STATISTICAL DIAGRAMS.

With the view of presenting a ready means for comparing the economic progress of New Zealand and the Australian Colonies, some of the leading statistical features, common to all, have been collected and thrown into graphic form, a method of representation which has the double advantage of appealing to the understanding by means of an expression of form as well as of figures, and is especially applicable to purposes such as the present.

The period shown is that from 1868 to 1881, and the diagrams will afford opportunity for much interesting comparison, illustrative of the more or less rapid advances in material prosperity made by the Australasian group of colonies.

The diagrams treat of the following subjects :—

No. 1.—Population.

This shows the ratio of increase in the population of New Zealand and the Australian Colonies, England being also included for purposes of comparison. The great leap made by New Zealand in 1874 was due to the fact of the Immigration and Public Works Act having that year come into active operation, under the provisions of which

an extraordinarily large number of immigrants were brought out by the Government. The somewhat low position shown in 1878 and 1881 is accounted for by the circumstance of an error having accumulated in the estimated yearly returns of population between the periodic census of 1874 and 1878 and 1881, which necessarily lowers the apparent rate of increase for these years.

Next to New Zealand, Queensland shows the greatest fluctuations, the highest being in 1874 and 1875, a sudden deep fall appearing next year, an abrupt rise in 1877, and another drop in 1878.

In New South Wales and South Australia the rate of increase is shown to have been pretty steadily improving the whole time, while in Victoria it steadily declined up to 1879, but recovered during the two subsequent years. Tasmania, up to 1878, occupied the lowest position, an actual decrease in the population of 0·5 being indicated in 1875; but since that year there has been a progressive increase, and it now stands at the head of the list.

No. II.—Marriages.

The marriage-rate per thousand of population has fluctuated considerably in all the colonies except Victoria, the rate there having steadily declined until 1879, since which year there has been a marked recovery. The only colonies showing a higher rate, in 1878, than England, in 1875, are South Australia and New South Wales; New Zealand, Tasmania, and Queensland standing next in the order named, near one another; Victoria being much lower.

No. III.—Births.

The birth-rate exhibits a general decline in the whole group, with the exception of Tasmania. All the colonies show a higher rate than England, with the exception of Victoria and Tasmania, the rate in the latter colony continuing extraordinarily low until 1878, which year shows a decided improvement. The almost continuous fall in the line representing Victoria is very remarkable.

No. IV.—Deaths.

This diagram exhibits a curious uniformity in the general lines of fluctuation, the death-rate in the whole of the group being lowest in the years 1871 and 1881, and highest in the year 1875. New Zealand occupies a remarkably good place in this diagram, her death-rate averaging about half that of England. Of the colonies, Queensland has the worst position, but in all the death-rate contrasts very favourably with the rate of the Home-country. New South Wales, Tasmania, South Australia, and Victoria are placed very near to each other.

No. V.—Imports and Exports. No. VI.—Local Exports.

In the first of these diagrams South Australia and New South Wales occupy the highest position; and in the second Queensland and South Australia. Neither Victoria nor New Zealand has maintained the position held at the commencement of the period under notice, and Tasmania stands so low in both cases as to be seemingly quite out of the race.

No. VII.—Savings.

In this diagram, which exhibits the rate of deposits in Post Office and other Savings Banks to population, all the colonies, it is shown, have made considerable progress. In South Australia and Queensland the advance has been remarkably great and rapid; Tasmania and New Zealand have, to a large extent, followed their good example; and New South Wales and Victoria appear to have somewhat lagged behind until 1880.

No. VIII.—Railways.

The proportion of constructed railways to population is shown in this diagram. The place occupied by New Zealand is marked 2·66 miles per 1,000 of population; Queensland and South Australia have a still higher percentage, owing to their wide-extending but sparsely-populated territories; and all the colonies stand higher than the United Kingdom, the proportion in that country being 0·54 miles per 1,000.

No. IX.—Telegraphs.

The long trans-continental lines necessarily give prominent places in this diagram to Queensland and South Australia. New South Wales, New Zealand, and Tasmania come next in order, very close together; then Victoria.

No. X.—Cultivation.

This diagram exhibits the area of land in cultivation (including land under sown grasses) in proportion to the population. The extraordinary progress made by New Zealand and South Australia in this direction is very strikingly shown. Tasmania occupies an almost unchanged medium position, and the Colonies of Victoria, New South Wales, and Queensland have preserved, in near neighbourhood, a very low level, Victoria, however, showing a slight rise in the last three or four years.

No. XI.—Wheat.

The average yield of wheat per acre in the Australian Colonies, shown in this diagram, contrasts favourably with the general average

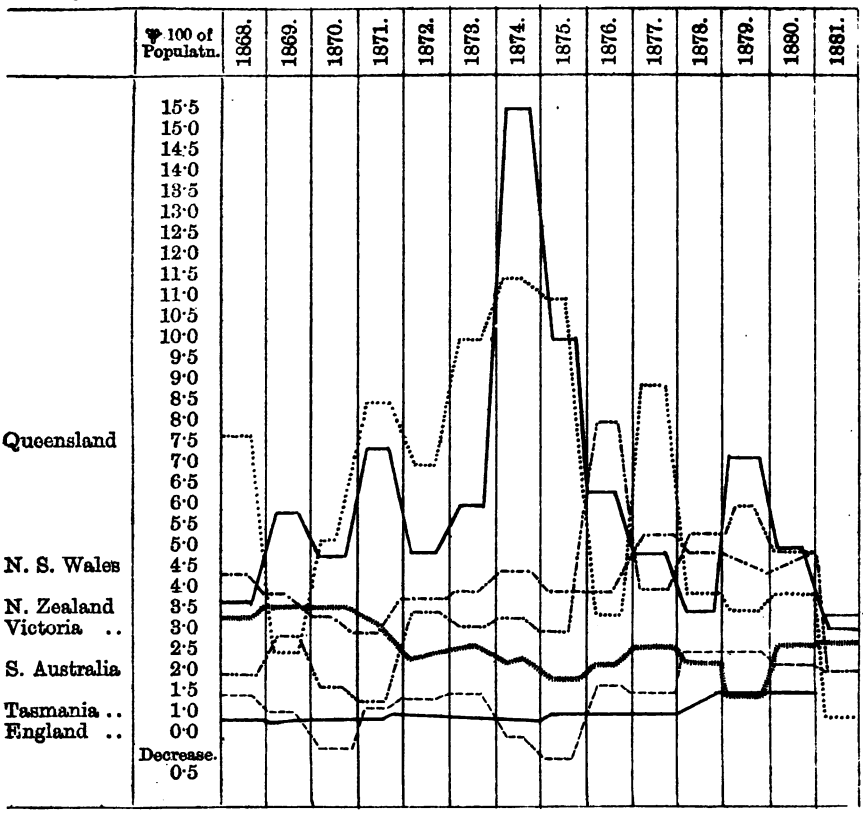
given of America. The yield in New Zealand stands considerably higher than that of the other colonies, Tasmania taking second place, New South Wales being next, then Queensland, Victoria, and South Australia, the average of the last-named colony being lower than that of America.

No. XII.—Gold.

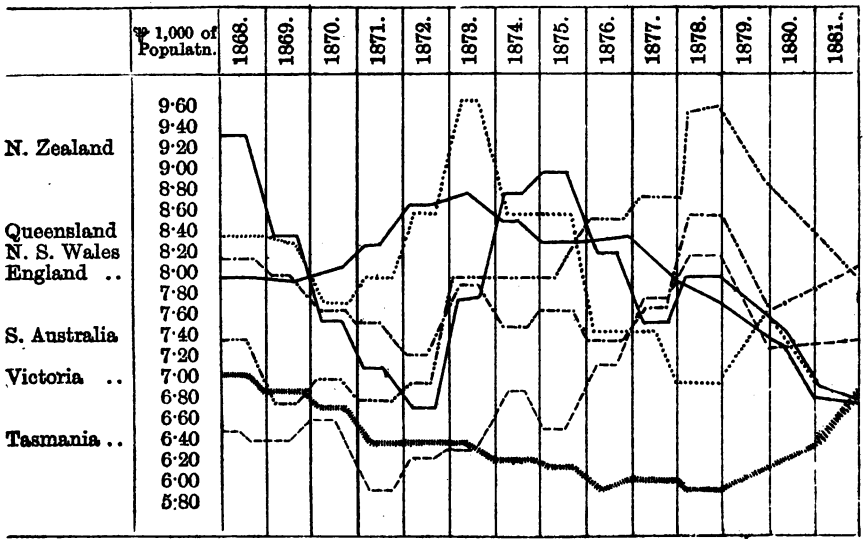
The value of gold raised in proportion to population during the years 1868–81, in the Colonies of Victoria, New South Wales, Queensland, and New Zealand, is shown in this diagram so far as the information at command will permit. The decline in the quantity of gold raised in Victoria and New Zealand is very marked; the yield in New South Wales has fluctuated very little; and in Queensland the quantity of gold raised in 1874 was nearly double that of 1868, but it has since been falling off.

By Authority: George Didsbury, Government Printer, Wellington.—1883.

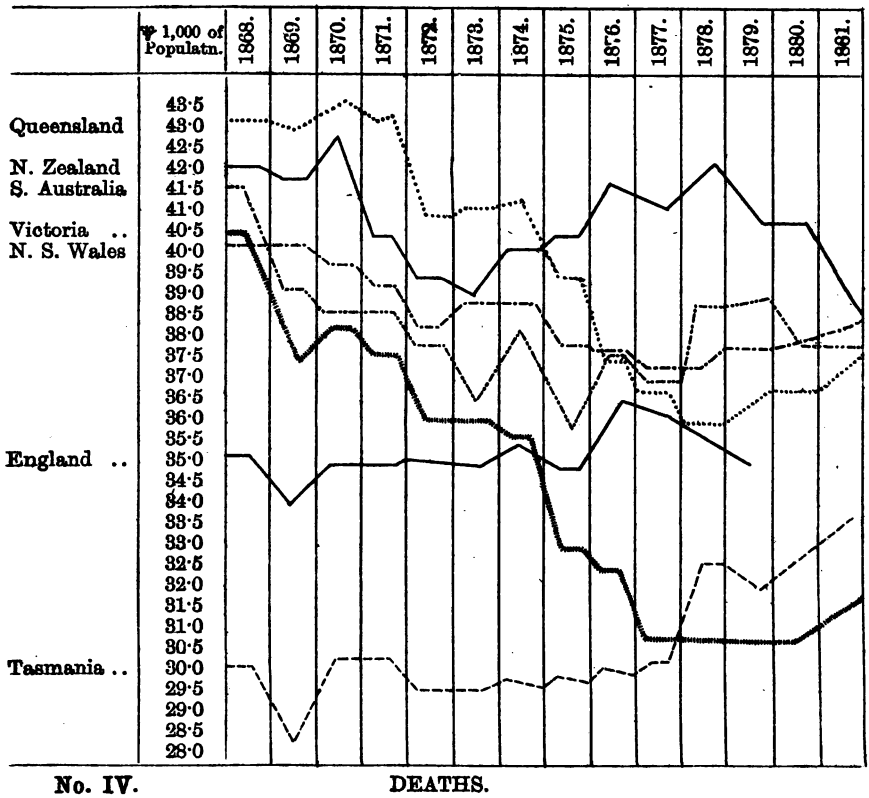
No. I. INCREASE OF POPULATION.



No. II. MARRIAGES.



No. III. BIRTHS.



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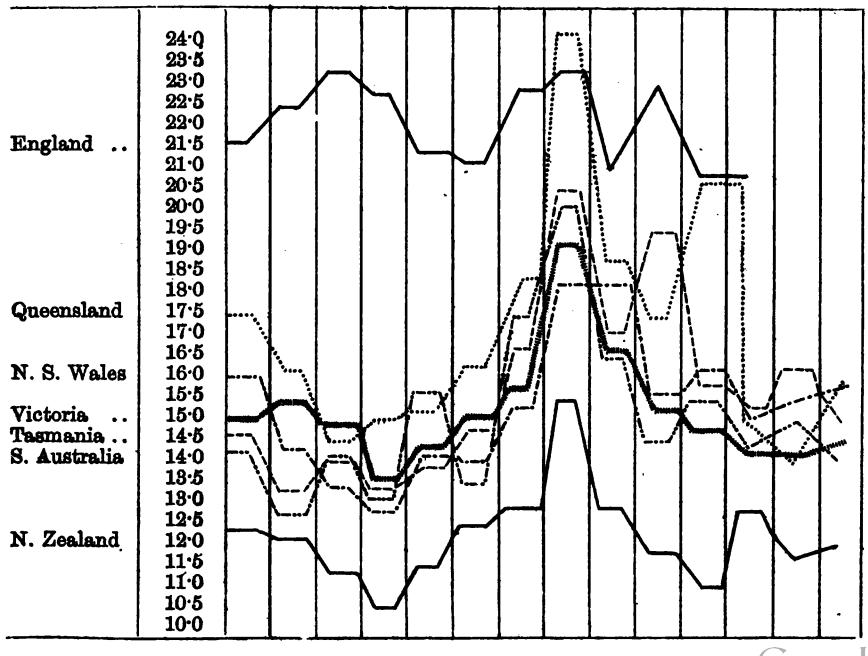
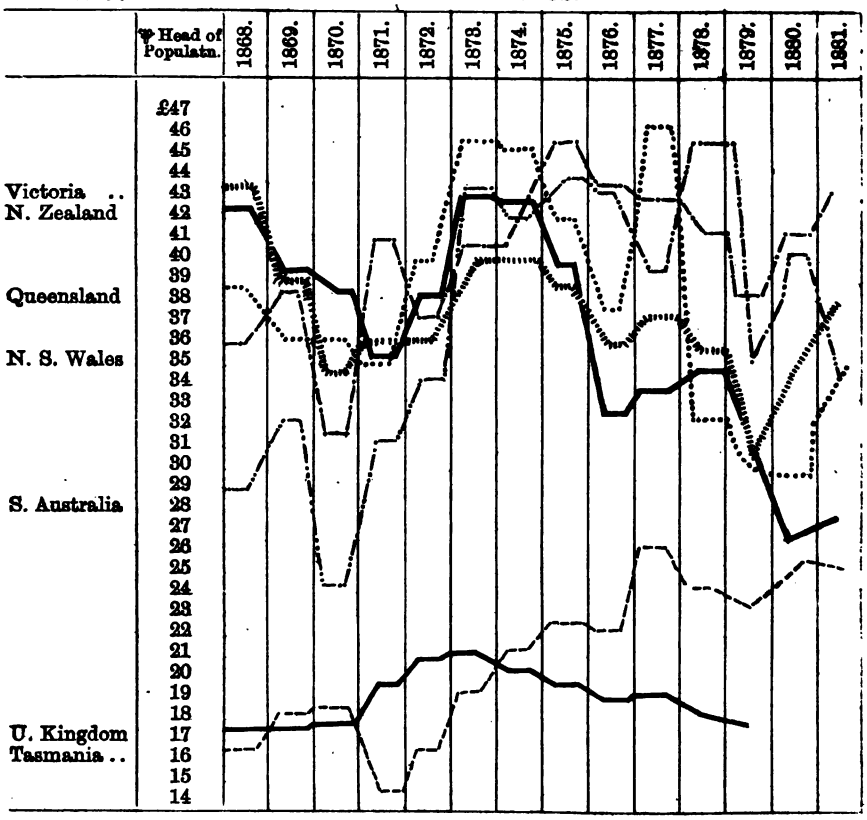
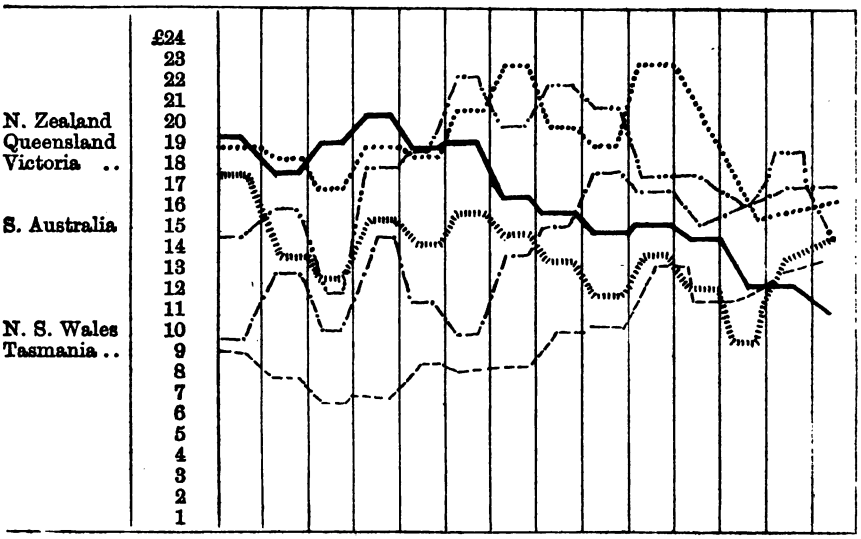


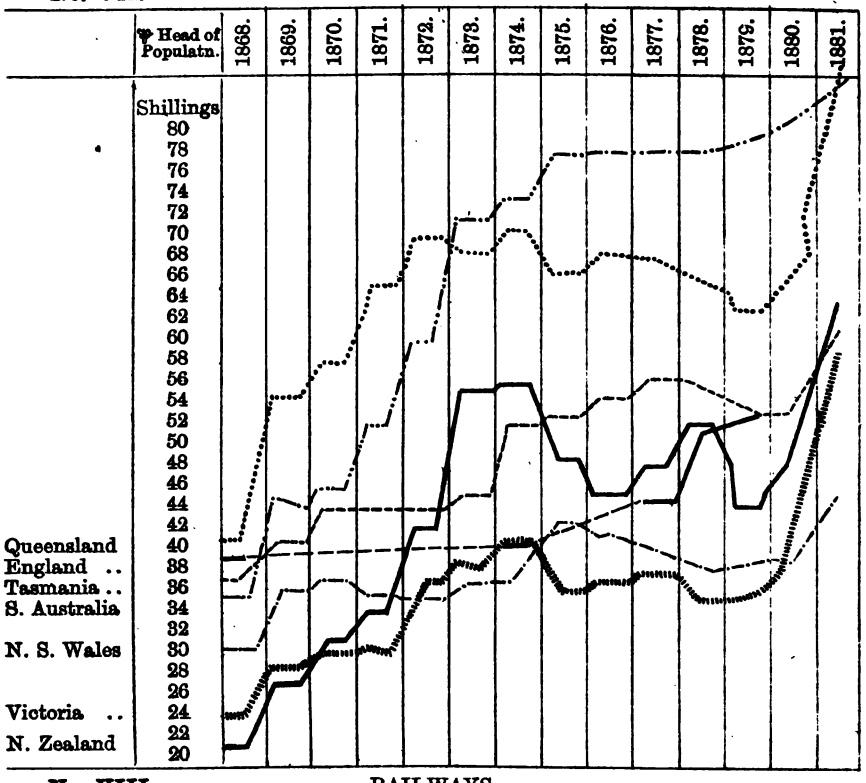
No. V. IMPORTS AND EXPORTS.



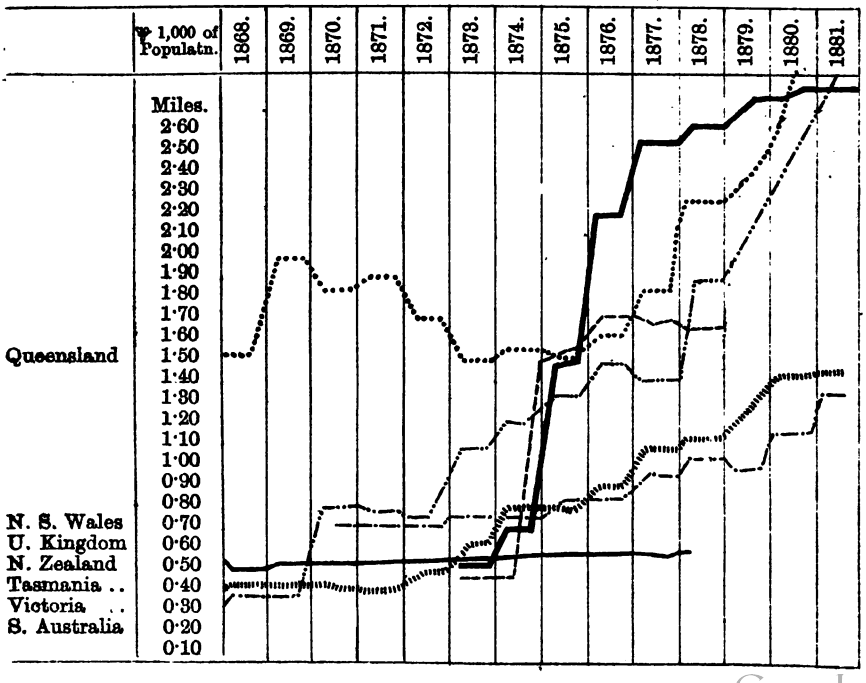
No. VI. LOCAL EXPORTS.



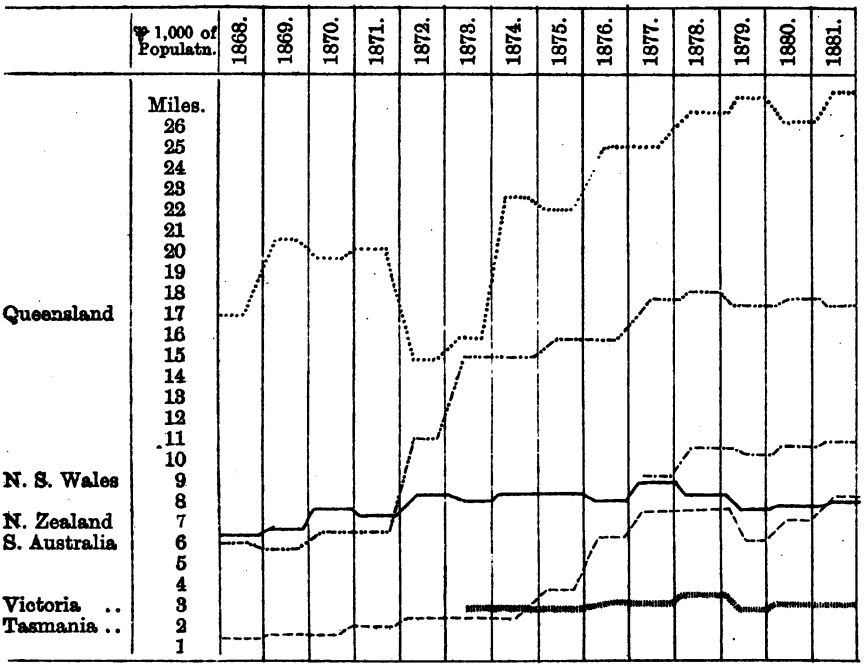
No. VII. DEPOSITS IN SAVINGS BANKS.



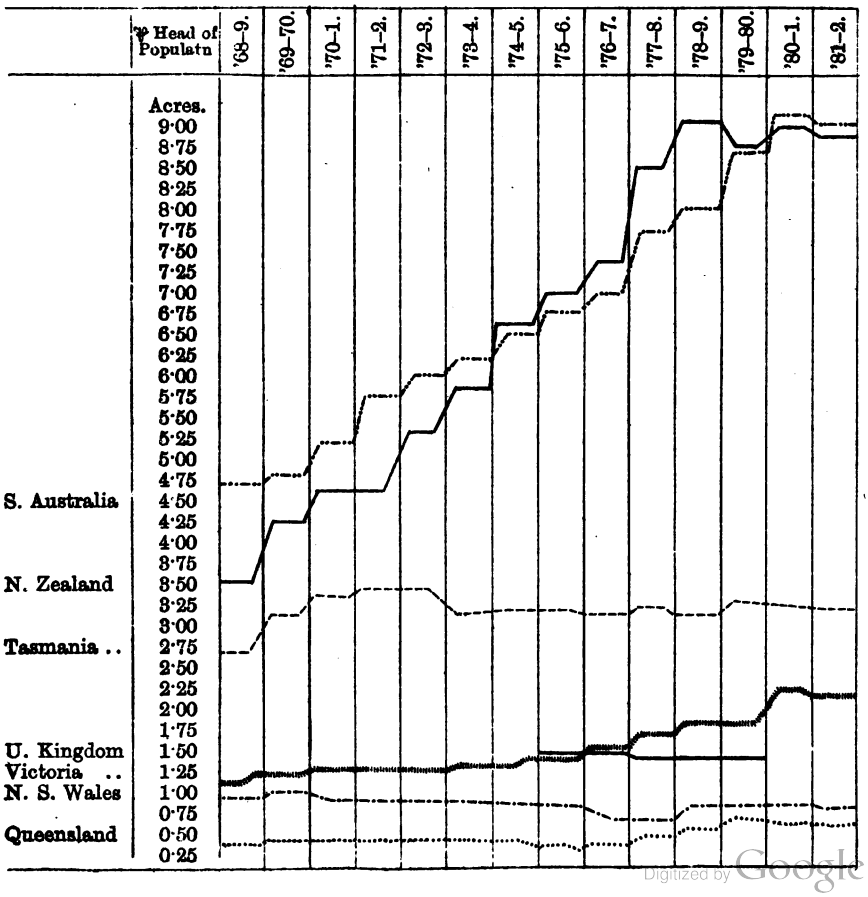
No. VIII. RAILWAYS.



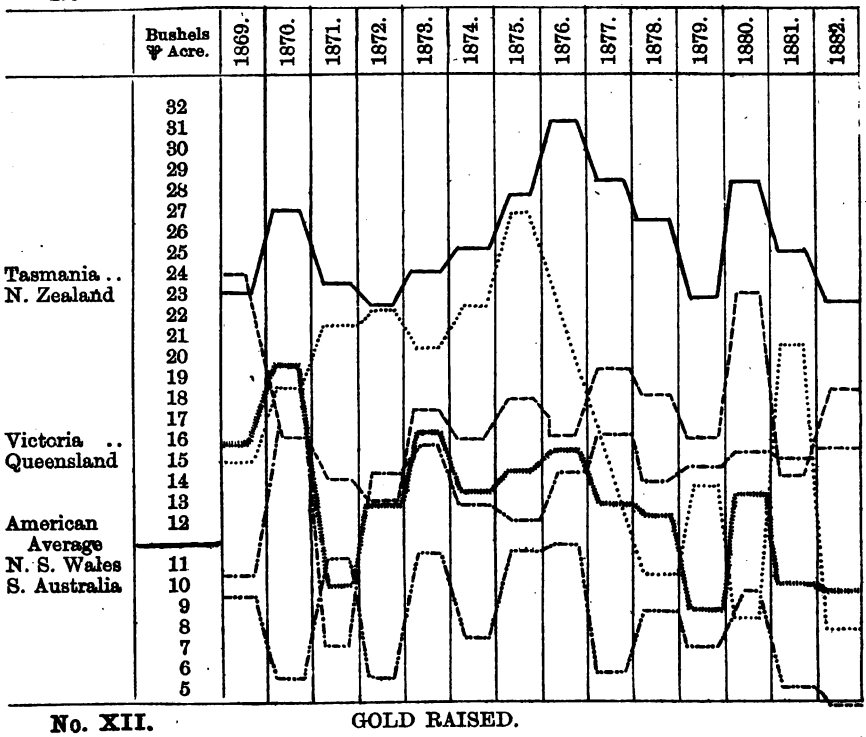
No. IX. TELEGRAPHS.



No. X. LAND IN CULTIVATION.



No. XI. AVERAGE YIELD OF WHEAT.



No. XII. GOLD RAISED.